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Woke (P. A.). **Effects of some ingested Insecticides on the Midgut Wall of the Southern Armyworm Larva.**—*J. agric. Res.* **61** no. 5 pp. 321–329, 5 pls., 18 refs. Washington, D.C., 1940.

The following is substantially the author's summary. Histopathological effects of certain insecticides on the midgut wall of sixth-instar larvae of *Laphygma* (*Prodenia*) *eridania*, Cram., were studied. Lethal or large doses of poison were fed by the sandwich method, and after sufficiently long intervals of time the larvae were killed and the tissues prepared by histological methods. Similar preparations of larvae that had not ingested poisons were used for comparison. The ingestion of arsenicals (lead arsenate, Paris green, calcium arsenate, calcium arsenite, and arsenic trioxide) was followed by disintegration of the midgut epithelial cells and damage to the midgut muscle fibres. Disintegration of the substance of the cytoplasm and nuclei of the epithelial cells followed the ingestion of sodium fluoride. The epithelial cells of larvae that had ingested sodium fluoaluminate (synthetic cryolite) were greatly disintegrated, and the cross striations of the muscle fibres were faint or obliterated. The ingestion of barium fluosilicate, phenothiazine [thiodiphenylamine], and rotenone was followed by no changes in the epithelium or muscle fibres that could be attributed with certainty to these substances.

Carruth (L. A.). **The Corn Ear Worm and its Control.**—*Circ. N. Y. St. agric. Exp. Sta.* no. 190, 14 pp., 8 figs. Geneva, N.Y., 1940.

The chief injury caused by *Heliothis armigera*, Hb., in New York State is that to the ears of sweet maize, though field maize, lima beans and more rarely, tomatos and geranium cuttings are also attacked. The most practical method of control on sweet maize is the application of highly refined white mineral oil to the tips of the ears after pollination is complete. The oil can be rendered more effective by the addition of pyrethrum extract [*R.A.E.*, A **28** 184] or possibly dichloroethyl ether [**29** 217]. Simple devices for carrying out the treatment are described.

It is believed that practically no pupae of *H. armigera* survive the winter on the mainland of New York, but a survival not exceeding 5 per cent. occurs, at least in some seasons, on Long Island [*cf.* **26** 564], where two generations and possibly a partial third develop each year. Moths from overwintered pupae are usually present by the end of June, at which time the first eggs are generally found. The heavy mortality of overwintering pupae is partly offset by the fact that an average female lays at least 1,000 eggs. These are usually deposited on fresh maize silks and hatch in about three days ; the young larvae pass along the " silk channel " and feed on the kernels of the developing ear. On Long Island, the pupal stage lasts 14–16 days in summer. The early summer generation requires about a month to complete development, but the second generation requires a longer period as temperatures are lower. The early summer generation varies in abundance, although some serious injury is caused every year. During the period of pupal development in late July and August, hardly any injury of commercial importance occurs, and if only limited plantings of sweet maize are to be made, this period is recommended for harvesting, so that hybrid sweet maize maturing in about 80 days should be planted in mid-May. The most serious injury occurs between mid-August and the end of the growing season [*cf.* **26** 271]. Eggs are laid abundantly throughout this period, and some of these, particularly those laid in September, represent the partial third generation, which is seldom able to complete development before the end of the season.

On the mainland, infestations appear to arise from moths that have migrated, both actively and with the assistance of air currents, from more southerly regions. Most of these moths are probably members of a second generation, and infestation on the New York mainland seldom begins before mid-August, and does not usually become injurious until even later in the season. Infestations may be serious locally, but are less serious generally than those occurring regularly on Long Island during late summer.

During 1939, much of the injury to sweet maize that was attributed to *H. armigera* was actually caused by *Laphygma frugiperda*, S. & A.; the larvae attack all portions of the ear and other parts of the plant, whereas most injury of practical importance caused by *H. armigera* in New York is confined to the tip portion of the ear.

JEWETT (H. H.). **Wireworm Injury to Tobacco Plants.**—*Bull. Kentucky agric. Exp. Sta.* no. 398, 16 pp., 5 figs., 6 refs. Lexington, Ky., 1940.

Of the four species of wireworms that attack newly-set tobacco plants in the region of Kentucky where tobacco follows bluegrass [*Poa*] in rotation [*cf. R.A.E.*, A **28** 367], *Drasterius* (*Aeolus*) *mellillus*, Say, which comprises about 90 per cent. of the total population, and *Conoderus auritus*, Hbst., are the most important. The larvae of these species are briefly described, and an account is given of investigations on their bionomics and control carried out in 1934–39. Both had one-year life-cycles and overwintered as larvae and as adults. Adults of *D. mellillus* were abundant in late summer and early autumn and again in spring and early summer, but emergence was observed to continue from 20th April until 11th November. The adults that overwinter do so under débris on the ground. The longest period survived by an adult that emerged from a spring pupa was from 14th June until 5th September. In autumn, larvae in various stages of development were present in the soil; some completed their development in the same season, but others overwintered and completed development in the following spring or summer, pupation beginning as early as 8th April. The bionomics of *C. auritus* were similar. Pupae were found from 25th April until 21st September, and emergence from them continued from 2nd May until 5th November. The longest period of survival of an adult that emerged from a spring pupa was from 7th June until 6th October.

Injury to tobacco by these wireworms is often attributed to sod webworms [*Crambus*], which are active during the same period, but whereas wireworms generally tunnel into the stalks, webworms cut through or partly through the stems or buds. The percentage of plants injured by wireworms in 1934–38, inclusive, varied from 22·9 to 61·1, and the percentage destroyed in 1935–39 from 1·1 to 3·1. The plants can recover from severe injury, but recovery is slower and the subsequent growth much more irregular on poor than on fertile soil. Small, slender plants recovered slowly and made irregular growth, those with stems about 7 mm. in diameter recovering more quickly than smaller ones. Tender plants were more severely damaged than well-hardened ones, and the buds of short and deeply-set plants were also seriously injured. The population of wireworms in new bluegrass sod (7,260 larvae per acre in 1934) increased rapidly; in three years it was more than half (32,670 per acre) and in four years it was greater (65,340 per acre) than that in old sod (61,710 per acre).

Relatively more plants were injured when set early than when set late. The difference was slight until about 15th June, when there was a reduction of approximately 50 per cent. in the percentage of injured plants; this date, however, is considered to be a little late for the general setting of tobacco in Kentucky. Injury was reduced slightly by thorough cultivation before the plants were set or by setting the plants on ridges, but not by autumn ploughing, applications of sodium nitrate to plants on fertile soil shortly after they were set, or halving the normal distance between plants. There was no significant difference in susceptibility in four varieties of tobacco, and the results obtained on three plots planted with tobacco for two years in succession were inconclusive, the reduction in injury in the second year being considerable on two plots and negligible on the third.

RICHARDSON (C. H.). **Advances in Entomology.**—*Industr. Engng Chem.*, News Edn, **19** no. 2 pp. 77–88, 8 figs., 183 refs. New York, N.Y., 1941.

This paper consists of brief notes on the results recorded in 178 papers dealing chiefly with recent work on insecticides, and thus serves as a useful index to the literature concerned. It is arranged under the following headings: Stomach Poisons; Contact Poisons; Control of Termites and other Wood-infesting Insects; Insecticides of Plant Origin; Wetting and Spreading of Sprays; Fumigants; Attractants and Repellents; Methods for testing Insecticides and evaluating Toxicological Data; Reviews.

TATTERSFIELD (F.), MARTIN (J. T.) & HOWES (F. N.). **Some Fish-poison Plants and their Insecticidal Properties.**—*Kew Bull.* 1940, no. 5 pp. 169–180. London, 1940.

The following is largely the authors' summary. The distribution, native uses and contact insecticidal properties of a number of fish-poisoning plants are described. None is of the same order of effectiveness as *Derris elliptica.* The most interesting from an insecticidal point of view are a vine from the British Solomon Islands, indistinguishable from *Derris trifoliata*, the leaves of which were somewhat more toxic than the root to *Aphis rumicis*, L., *Dolichos pseudopachyrhizus* from Kenya, *Millettia pachycarpa* from India, *Tephrosia macropoda* from Natal and *T. vogeli* from Uganda.

WIGGLESWORTH (V. B.). **The Effect of Pyrethrum on the Spiracular Mechanism of Insects.**—*Proc. R. ent. Soc. Lond.* A **16** pt. 1–3 pp. 11–14, 2 figs., 9 refs. London, 1941.

The following is the author's summary: The destructive action of pyrethrum on the central nervous system of insects is confirmed. But it is shown that in *Rhodnius* there is little or no increase in evaporation from insects paralysed with pyrethrum until after death; and that in paralysed *Cimex* the spiracles are kept closed and still react to carbon dioxide. Desiccation cannot therefore be the main cause of death after pyrethrum poisoning.

[Gilyarov (M. S.).] Ghilarov (M. S.). **Einige Gesetzmässigkeiten in der Ausnutzung von Kok-Saghyz durch Insekten.** [Some Laws governing the Utilisation of Kok-saghyz by Insects.] [*In German.*] *C. R. Acad. Sci. URSS* (N. S.) **28** no. 9 pp. 846–849, 5 refs. Moscow, 1940.

Investigations have shown that *Taraxacum kok-saghyz*, which is cultivated in the Russian Union, is attacked by many species of insects [*cf. R.A.E.*, A **27** 44, etc.], most of which have for long been associated with indigenous species of *Taraxacum*. A list of some of them is given, showing the parts of the plant that they attack. Though several species may occur on an individual plant, competition between them is reduced when each is restricted to a different part of it. This is further illustrated by a list of the Aphids that infest *T. kok-saghyz*, showing the parts they attack, and it is stated that only in cases of extreme overcrowding, which are rare, have Aphids of one species been observed infesting parts that are usually occupied by another.

[Rubtzov (I. A.).] **Рубцов (И. А.). Climatic Characteristics of the Reservation Grounds and Periods of the Mass Increase of Siberian Acrididae.** [*In Russian.*]—*Probl. Ecol. Biocenol.* no. 4 pp. 35–88, 2 graphs, 31 refs. Leningrad, 1939. (With a Summary in German.) [Recd. 1941.]

To find the climatic characteristics of the outbreak areas of Siberian Acridids, a study was made of the average climatic records for a number of relevant meteorological stations in the temperate belt of Siberia. The mean annual temperature in most outbreak areas is 0–1°C. [32–33·8°F.], though outbreaks are most frequent where it is 2°C. [35·6°F.]; the mean monthly temperatures are of greater importance, and are 10–11°C. [50–51·8°F.] in May and September and 15–20°C. [59–68°F.] in June–August. The minimum air temperatures are not decisive limiting factors, for *Aeropus sibiricus*, L., and associated species occur in areas in which they reach −30°C. [−22°F.]; the maximum temperatures vary between 35 and 40°C. [95 and 104°F.]. As the threshold of development of most Siberian Acridids lies at 10–11°C., the number of days in the year having an average temperature for the 24 hours of over 10°C. is of importance; in outbreak areas it is not less than 100, and in the most favourable ones reaches 130–140. The limiting effect of precipitation is more definite than that of temperature. The average annual rainfall in outbreak areas is 250–260 mm. [about 10 ins.]; only sporadic outbreaks occur where it is 300–360 mm., and Acridids never become sufficiently numerous to be injurious where it is 450–500 mm. The seasonal incidence is more important than the annual total, and in the most favourable areas the monthly rainfall for May and September does not exceed 30 mm. [1·18 in.]. The snow cover is about 30 mm. thick, and relative humidity comparatively low, with minima in May and September. In areas in which outbreaks occur only sporadically, there is a humidity minimum in May. It is stressed that although temperature and precipitation are of major importance, the location of outbreak areas is determined by the interaction of all meteorological factors, and that the actual microclimates of Acridid habitats are drier and warmer by 2–3°C. [3·6–5·8°F.] during the summer months than the climate registered in screens.

Next, the climatic records for the years in which there were mass outbreaks of *Aeropus sibiricus* over large areas were studied and compared with the normals. Such years are characterised by abnormally low rainfall, particularly in May and September, which are also warmer than usual ; it is suggested that the drought at such periods acts indirectly by preventing fungous infection of the eggs. The snow cover forms late and disappears early in winters preceding outbreaks. It is pointed out, however, that outbreaks of different species of Siberian Acridids do not occur simultaneously, for each species has its own climatic requirements, and the fluctuations in climatic factors, which are, moreover, modified by peculiarities of each habitat, will have a different effect on each species. Nevertheless, there exists a certain periodicity in the occurrence of dry years that favour mass multiplication of xerophilous species such as *A. sibiricus*, *Chorthippus albomarginatus*, DeG., *Pararcyptera* (*Arcyptera*) *microptera microptera*, F. W., and *Stauroderus scalaris*, F. W., which are moreover capable of active migration and consequently cause damage to crops. A wave of such outbreaks usually moves over a number of years from west to east, and from the centre of an outbreak area to the periphery.

The climate also acts indirectly on Acridids by affecting their parasites, and by its effect on fertility through food. Experiments with *A. sibiricus*, *C. albomarginatus* and *S. scalaris* showed that females exposed to the sun lay more eggs than those kept in the shade. On the other hand, Acridids require large amounts of food ; thus, a rich stand of *Agropyrum repens* and *Bromus inermis*, weighing about 1,000 gm. per sq. metre, was completely eaten up in a month by a population of *C. albomarginatus* numbering 50 per sq. metre. The vegetation in outbreak areas is comparatively poor and cannot support more than 20–30 Acridids per sq. metre. In dry hot years, the graminaceous food-plants are the first to disappear, and the maturing adults remain chronically undernourished. This diminishes their fertility, for in an experiment in which one lot of Acridids was given plenty of fresh food, while another was kept undernourished, the number of eggs per female was nearly five times as great in the former as in the latter.

Climatic factors have a great effect on the incidence of fungous diseases of the egg-pods, which largely control the outbreaks [*cf. R.A.E.* A **22** 676]. After the exceptionally humid summer of 1932 in the Irkutsk region, fungous infestation of egg-pods reached 40 per cent. in the autumn, and 80 per cent. in the late and cold spring of 1933 ; the egg-pods of *A. sibiricus* were affected to a greater degree than those of *C. albomarginatus*. The hoppers and adults of *Podisma pedestris*, L., *C. albomarginatus* and *A. sibiricus* are liable to be infested by fungi, which become most important towards the end of outbreak periods, especially in humid years following several dry ones, but *Pararcyptera m. microptera* is seldom affected. Other parasites might be divided into two groups, *viz.*, *Epicauta megalocephala*, Gebl., *Mylabris* spp., and the Bombyliid, *Systoechus autumnalis*, Wied., which are usually most numerous in dry steppe habitats and increase in numbers in relatively dry years, and *Sarcophaga* (*Blaesoxipha*) *lineata*, Fall., and *Mermis* spp., which occur in more humid habitats and increase in relative importance in wet years.

The possibility of basing reliable forecasts on laboratory studies of Siberian Acridids [*cf.* **24** 396] and climatic characteristics of outbreak areas and years is discussed, and it is concluded that, for areas where normal climatic conditions favour outbreaks, they will be possible only when meteorological forecasts for at least six months become available. In other parts of the distribution area, it should be possible to forecast an increase or decrease in Acridid populations by comparing the climatic records for the preceding period with the normals by means of climatographs, and supplementing this by observations on the size and density of oviposition sites and the degree of fungous infection and parasitism. When there are 5 or more egg-pods per sq. metre, and parasitism in the autumn does not exceed 30 per cent., an outbreak may be expected following a favourable spring. To delimit the most dangerous areas in any year, it is recommended to plot hydrothermic isopotids [*cf.* **27** 146] for all the outbreak areas. A decrease of the hydrothermic coefficient to 8 or 10 in any area will indicate conditions favouring outbreaks of *A. sibiricus* [*cf. loc. cit.*] or of *C. albomarginatus* and *S. scalaris*.

[RADZIEVSKAYA (S. B.).] **Радзиевская (С. Б.). Concerning the Hibernation of the Ladybird and the Struggle with the Aphis.** [*In Russian.*]—*Probl. Ecol. Biocenol.* no. 4 pp. 268–275. Leningrad, 1939. (With a Summary in English.) [Recd. 1941.]

In the autumn of 1929, large groups of hibernating adults of *Brumus octosignatus*, Gebl., *Coccinella septempunctata*, L., and *C. undecimpunctata*, L., were found in the mountains near Tashkent, in north-eastern Uzbekistan. *B. octosignatus* gathered in numbers on narrow hill ridges exposed to the wind, forming layers up to 1½ ins. thick among fallen leaves under small shrubs, whereas the other two Coccinellids sheltered under stones higher up on the mountains. Single examples of *Adonia variegata*, Gze., sometimes occurred together with *B. octosignatus*. The latter apparently collected for hibernation in the same spots every year, as the sites were covered with a layer, in some cases as thick as 4 ins., of the remains of dead ladybirds. Examples of *B. octosignatus* showed strong negative phototropism during autumn, but in spring, they were attracted by the light and warmth of the sun. The beginning of migration from the hibernation quarters depended on temperature, those situated at the higher altitudes not being abandoned until the end of May.

In the laboratory, all four species attacked various Aphids, including those that infest cotton, but not the cabbage aphis [*Brevicoryne brassicae*, L.]. In the field, *Brumus octosignatus* and *C. undecimpunctata* readily destroyed *Aphis laburni*, Kalt., which indicates that they may be of great value in the control of Aphids in the spring. In the laboratory, reproduction of these two species continued until late autumn. *C. septempunctata* fed on larvae of *Hypera* (*Phytonomus*) on lucerne and on *A. laburni* on cotton, but abandoned the fields in August. *Adonia variegata* became abundant on cotton towards autumn, and appears to offer the greatest promise of control of Aphids at this season, when they are particularly injurious. If it were bred in the laboratory, it might be liberated in cotton fields in autumn, or if mass hibernation quarters were discovered, it could be collected and released in spring.

[POLEZHAEV (V.).] **Полежаев (В.). The Dependence of the Oviposition of the Lilac Moth** (*Gracilaria syringella* **Fabr.) on the Size of the Leaves.** [*In Russian.*]—*Probl. Ecol. Biocenol.* no. 4 pp. 289–295, 3 graphs, 4 refs. Leningrad, 1939. (With a Summary in German.) [Recd. 1941.]

Investigations on *Gracilaria syringella*, F., on lilac in and near Moscow in 1934 showed that, as in the case of *Lithocolletis populifoliella*, Treitschke, on poplar [*cf. R.A.E.*, A **23** 105], oviposition is regulated by the size of the leaves. Leaves infested with larvae were collected in June and August from lilac bushes, and the empty egg shells at the edges of the initial mines were counted. A statistical analysis, details of which are given, showed that the average number of eggs deposited varied directly with the area of the leaf, the average maximum being about 20 eggs per leaf. It is not known how the ovipositing moth discriminates between the smaller and larger leaves.

[ZOLOTAREV (E. Kh.).] **Золотарев (Е. Х.). Is there a Locust Reservation in the Volga-Kama District?** [*In Russian.*]—*Probl. Ecol. Biocenol.* no. 5–6 pp. 207–218, 2 maps, 8 refs. Leningrad, 1939. (With a Summary in English.) [Recd. 1941.]

During the last few years, the population of *Locusta migratoria*, L., in the central part of the Russian Union has tended to increase. In this connection, a survey of relief, soil, vegetation and climatic conditions was made in the Tartar Republic in the middle Volga region, where a severe outbreak occurred in 1921–23 [*cf. R.A.E.*, A **14** 606], to determine whether this area is a potential reservation of the species. However, not even isolated individuals were found. It is concluded that the area is unsuitable for the permanent survival of *L. migratoria*, owing to unfavourable climatic conditions, as it lies to the north of the summer isotherm 13·6°C. [56·5°F.], which forms the northern limit of the area of distribution of this locust [*cf.* **17** 139–140]. However, favourable places with light sandy soil are found in the Tartar Republic, chiefly along the terraces of the river Volga, and these may become secondary breeding areas during favourable years, when they may be invaded from reservations in the Province of Kuĭbuishev [*cf.* **25** 160].

[RUMYANTZEV (M.).] **Румянцев (М.). Variations in Fertility of Females in** *Pyrausta nubilalis* **Hb. in different Years, and Factors determining these Variations.** [*In Russian.*]—*Probl. Ecol. Biocenol.* no. 5–6 pp. 219–227, 3 graphs, 6 refs. Leningrad, 1939. (With a Summary in English.) [Recd. 1941.]

It has been stated by various workers who have carried out laboratory investigations on *Pyrausta nubilalis*, Hb., that the fecundity of the females varies with the relative humidity of the air. In their experiments, however, the moths were deprived of water, whereas in nature they daily drink rain or dew or the nectar of flowers. They usually avoid strong sunlight, but during severe droughts they have been observed to abandon their day-time shelters and to congregate on flowering plants. In the author's experiments, individuals kept at a high relative humidity did not live long if they were given no water to drink, and studies during the years 1931–35 afforded no indication of a direct relation between fertility and humidity. Fertility was high in 1932 and 1934, which were years of drought, and was lowest in 1933, which was a wet year.

It was observed in the course of the investigations that the size and weight of pupae of *P. nubilalis* taken from hemp varied directly with the vigour of the plants and the thickness of the stems, which indicates that larval nutrition exercises an important influence on the size of the pupae and possibly on the fecundity of the resultant moths. In 1935, therefore, moths were reared from overwintered larvae, some of which were taken from thin and stunted hemp, some from vigorous plants with thick stems, and some from millet [*Panicum miliaceum*], all three groups being kept under identical conditions of temperature and humidity.

Females from all three groups began to lay eggs at practically the same time, and showed very little difference in the oviposition period or longevity, but the average numbers of eggs per female were 377, 209 and 275, respectively, in the groups from vigorous hemp, undersized hemp and millet. It is concluded that humidity affects the fertility of the moths indirectly by favouring the growth of the plants and thus increasing their nutritive value for the larvae. Variations from year to year in the fertility of the moth should, therefore, be correlated with the meteorological conditions of the period in which the larvae developed.

NEU (W.). **Der zeitliche Unterschied im Schwärmen von** *Melolontha hippocastani* **F. und** *M. melolontha* **L.** [The Difference in Time of Flight of *M. hippocastani* and *M. melolontha*.]—*Zool. Anz.* **129** pt. 7–8 pp. 177–184, 1 fig., 3 refs. Leipzig, 1940.

Observations here recorded in detail in a locality near Lake Constance in April–June 1939 showed that *Melolontha hippocastani*, F., begins its evening flight about half an hour earlier than *M. melolontha*, L. The difficulty of explaining this difference and the sudden start and termination of evening flight is briefly discussed ; it is concluded that the gradual reduction in light intensity is not the only factor concerned.

VITZTHUM (H.). **Die Deutonympha von** *Carpoglyphus lactis* (**L. 1763**) (**Acari, Tyroglyphidae**).—*Zool. Anz.* **129** pt. 7–8 pp. 197–201, 2 figs. Leipzig, 1940.

OBOUSSIER (H.). **Bemerkungen zur Arbeit von Dr. H. Graf Vitzthum über " Die Deutonympha von** *Carpoglyphus lactis* (**L. 1763**) **" in Bd. 129, S. 197.** [Remarks on Count Vitzthum's Paper on the Deutonymph of *C. lactis*.]—*T.c.* pt. 9–10 pp. 271–272.

In the first paper, Vitzthum criticises certain points in the description by Oboussier of the morphology of *Carpoglyphus lactis*, L. [*R.A.E.*, A **28** 163], notably the deutonymph, which she was the first to describe and figure, and gives a more detailed description of this stage based on two examples received from her. He has occasionally observed deutonymphs of this mite in nature on the heads of butterflies. He states that *C. lactis* occurs not only on dried fruits and jams, but also on butts of sweet wine. It enters the wine bottles when these are being filled and develops indefinitely on the surface of the wine, forming a layer of scum, even when the bottles are hermetically sealed. It is not known whether deutonymphs are produced in such circumstances. In nature, the mite probably develops in sweet plant juices.

In the second paper, Oboussier replies to Vitzthum's criticisms.

ZEUNER (F. E.). *Phlugiolopsis henryi* **n.g., n.sp., a new Tettigoniid, and other Saltatoria (Orthop.) from the Royal Botanic Gardens, Kew.**—*J. Soc. Brit. Ent.* **2** pt. 2 pp. 76–84, 1 fig., 8 refs. King's Somborne, Hants., 1940.

Phlugiolopsis henryi, gen. et sp. n., is described from adults of both sexes taken in the Tropical Fern House in the Royal Botanic Gardens at Kew, where humidity is high and the temperature varies from 70–80° F. during the day to 65° F. at night ; brief descriptions of the egg and last-instar nymph are also given. Adults were present from the middle of July until 20th October, when a female that had completed oviposition was taken, and nymphs in the last instar occurred up to the middle of August. This Tettigoniid is active at night, and mating occurred then from early August onwards. Six individuals that were kept under observation for over three weeks fed exclusively on small slow-moving insects, particularly *Aphis* sp. and *Pseudococcus adonidum*, L. (*longispinus*, Targ.) ; the feeding habits are described and compared with those of *Phlugiola dahlemica*, Eichler [*R.A.E.*, A **27** 109]. Young larvae of *Pieris brassicae*, L., were also eaten without adverse effect, though larger ones were shown to be poisonous to an adult of *Tettigonia viridissima*, L. The author attributes the scarcity of mealybugs in the Fern House in 1940 to the increase in numbers of *Phlugiolopsis* during that year and recommends its introduction into hot and damp greenhouses. A discussion of the scope of the subfamilies LISTROSCELINAE and MECONEMINAE is appended, with a list of the genera (including *Phlugiolopsis*) considered to belong to the latter.

Gryllodes sigillatus, Wlk., is abundant in work-rooms adjoining the Fern House and in several other heated houses, in which *Periplaneta australasiae*, F., also occurs.

CAMERON (E.). **The Biology and post-embryonic Development of** *Opius ilicis* **n. sp., a Parasite of the Holly Leaf-miner** (*Phytomyza ilicis* **Curt.**).—*Parasitology* **33** no. 1 pp. 8–39, 1 pl., 8 figs., 17 refs. London, 1941.

An account is given of the bionomics of *Opius ilicis*, Nixon, a Braconid parasite of *Phytomyza ilicis*, Curt., on holly [*Ilex aquifolium*] in England [*cf. R.A.E.*, A **27** 669]. The original description of the adults is quoted, and the immature stages are described. The distribution and host-relationships of the genus *Opius* are briefly reviewed. A list based on various authorities is given of over 90 species of *Opius*, showing the hosts from which they have been recorded and the countries in which the records were made, and the comparative morphology of Opiine larvae and the phenomenon of arrested development that occurs in some of them are discussed.

Adults of *O. ilicis* were reared from mined holly leaves collected in Buckinghamshire, Surrey, Berkshire and Hampshire. Where the percentage parasitism was highest, adults emerged from only 4 per cent. of the mines, although when hosts were dissected in early spring as many as 7 per cent. were found to be parasitised ; the reduction was due to unsuccessful competition with the Eulophid, *Chrysocharis gemma*, Wlk. [*loc. cit.*].

In Surrey in 1939, parasites emerged from the host puparia between 13th and 30th May and adults of *Phytomyza* between 11th and 25th May. Female parasites were rather more numerous than males, but in a collection made in Hampshire in 1937 the sexes were approximately equal in numbers. Oviposition was not observed. It is considered likely that a summer generation develops in an alternate host and that the resulting adults oviposit in mines of *P. ilicis* in December. First-instar larvae were found in the body-cavities of host larvae from early December until February or March, and in newly-formed puparia on 7th March. The development of the larva is arrested until after the host has pupated, when it proceeds rapidly, and three ecdyses occur within a short period. The larva completes its development within the host puparium in about a month, and the pre-pupal and pupal stages last about two days and three weeks, respectively. Several first-instar larvae may occur in the same host, but only one attains maturity. The adults survived for only a few weeks in the laboratory.

In a discussion of the value of *O. ilicis* in the control of the leaf-miner, it is concluded that as it is intrinsically inferior to *C. gemma*, the puparia from which it emerges represent hosts unparasitised by the latter, and the mortality resulting from the combined parasitism of the two species is greater than that from *C. gemma* alone. It is possible that its efficiency may be increased under the conditions prevailing in the holly areas of western Canada, where *P. ilicis* is a troublesome pest [**29** 417]. Reasons for the intrinsic superiority of *C. gemma* are briefly discussed.

VARLEY (G. C.). **On the Search for Hosts and the Egg Distribution of some Chalcid Parasites of the Knapweed Gall-fly.**—*Parasitology* **33** no. 1 pp. 47–66, 3 figs., 27 refs. London, 1941.

The following is substantially the author's summary. The egg distribution of five Chalcidoid parasites of *Euribia jaceana*, Hering, the Trypetid that attacks the flower heads of knapweed (*Centaurea*), was studied in a small area in England. The parasites were *Eurytoma curta*, Wlk., *E. robusta*, Mayr, *Habrocytus trypetae*, Thoms., *Torymus cyanimus*, Boh., and *Eupelmella vesicularis*, Retz.

A distinction is made between random search for hosts in the sense of Nicholson [*R.A.E.*, A **21** 369 ; **24** 6], in which the number of encounters between parasite and host is assumed to be proportional to the product of the population densities of the two species, and random movements, which imply that hosts far from the parasite are less available than those near to it. Random movements may give rise to a distribution of parasitism different from that to be expected if search were purely random. The species discussed do not all distribute their eggs at random among the hosts. Some superparasitise the hosts more, and one (*Eurytoma curta*) much less, than would be expected if the egg distribution were purely random, owing to peculiarities in the behaviour of the females during oviposition. Parasitism by *E. curta* is unevenly distributed in space, being higher in areas of high host density. This suggests that search is not exactly random, but is also concentrated in space, and a tentative explanation, based on the assumption that search is by random movements, is advanced. Parasitism by *E. robusta* is very patchy, and its non-random distribution is attributed to random movements performed by a very few parasites. The author concludes that these spatial discrepancies do not seriously affect the numerical accuracy of the assumption that search is random in small areas, and that the theory of Nicholson & Bailey [**24** 6] may be accurate to a first approximation.

MOORE (E. S.). **Control of the Kromnek (Spotted Wilt) Disease of Tomatoes.**—*Nature* **147** no. 3729 pp. 480–481, 3 refs. London, 1941.

The results are given of preliminary experiments with a spray of 1 lb. tartar emetic and 2 lb. sugar in 100 gals. water against *Frankliniella schultzei*, Trybom, on tomato in the eastern Cape Province. This thrips is the sole or principal local vector of the kromnek disease of tobacco and tomato, which causes heavy losses in the Cape Province and the Transvaal and has been identified with spotted wilt [*cf. R.A.E.*, A **28** 638]. Tomato seedlings in the cotyledon stage that were already being attacked by *F. schultzei* were sprayed in the out-door seed-bed in October, and applications were frequently repeated during the subsequent 9 weeks. Only 5 per cent. of the plants became infected and growth was vigorous and healthy, whereas plants in control beds a few yards away developed symptoms of the disease when 4 ins. high, and all became infected. Promising results were also obtained in experiments on a very small scale with transplanted tomato plants.

LEWIN (C. J.). **Northern Rhodesia Department of Agriculture. Annual Report for the Year 1940.**—8 pp. Lusaka, 1941.

In January 1940, a large swarm of *Nomadacris septemfasciata*, Serv., flew south-west along the railway belt in Northern Rhodesia and damaged young maize, and in February and March hoppers hatched along the railway belt and in the Luangwa Valley. At Chisamba, eggs were laid in and near maize fields, but many of the egg-pods were destroyed by *Scelio howardi*, Crwf., and the hoppers were dealt with successfully by means of poison baits.

Locusta migratoria migratorioides, R. & F., swarms of which entered the Abercorn district from Tanganyika Territory during the last quarter of 1939 and again in January 1940, was confined to the Northern Province. Oviposition and hatching occurred in the Abercorn and Kasama districts, but a campaign organised to protect native food-crops was successful. The resultant swarms were small and migrated westwards, and no reports of this species were received after July.

Locusts.—*Rep. Dep. Agric. Uganda 1939–40* p. 8. Entebbe, 1941.

The influx of *Locusta migratoria migratorioides*, R. & F., into Uganda in the crop year 1939–40 was much less than in the preceding season [*cf. R.A.E.*, A **28** 52], but extensive damage was done to millets in Lango, West Nile and Acholi, and to grazing in Karamoja. Unusually dry weather had an adverse effect on the locusts, and infestation by *Empusa grylli* was apparently responsible for the rapid decline in their numbers towards the end of the year. *Nomadacris septemfasciata*, Serv., visited most districts west of the Nile and damaged food crops in Toro and in Acholi. Investigations carried out by H. J. Bredo in the low-lying area west of Lake George showed that it is not a permanent breeding ground of *N. septemfasciata*, for no example of ph. *transiens* was found there.

Work of the Entomologist.—*Rep. Dep. Agric. Gold Coast* **1939–40** p. 3. Accra, 1940.

The main work of the Entomological Division during 1939–40 comprised further investigations on the insect pests of cacao in the Gold Coast [*cf. R.A.E.*, A **28** 438]. The Capsid, *Bryocoropsis laticollis*, Schum., which is closely related to *Sahlbergella* spp., was common on cacao at the Tafo Research Station and in the surrounding district. It has previously been recorded only as breeding on *Annona squamosa*. Attack was almost entirely confined to the pods of cacao, and as there is no severe damage to herbaceous tissue, it is less serious than that by *Sahlbergella* spp. The incidence of *S. singularis*, Hagl., and *S. theobroma*, Dist., rose in May and again in the following February, whereas *B. laticollis* appeared to vary in incidence with pod development only. The severe attack by *Sahlbergella* at the Station during April and May was considerably reduced by spraying with nicotine sulphate.

Flying swarms of the migratory locust [*Locusta migratoria migratorioides*, R. & F.] circulating in the Northern Territories early in April [*cf.* **28** 439] moved northwards into French territory during the month, and no further invasion took place. Parasites bred from the Psyllid [*Phytolyma lata*, Wlk.] that causes galls on iroko [*Chlorophora excelsa*] comprised the Encyrtid, *Psyllaephagus phytolymae*, Ferrière, the Eulophid, *Aprostocetus roseveari*, Ferrière, and two Eulophids of the genus *Tetrastichus*. All three Eulophids are probably hyperparasites. Other crop pests recorded during the year were *Bruchus impressithorax*, Pic, and *B. maculatus*, F. (*quadrimaculatus*, F.) in stored peas, and *Lepidosaphes* (*Coccomytilus*) *dispar*, Vayss., on cassava.

Brief reference is made to work in progress on the known and potential food-plants of fruit-piercing moths of the genera *Othreis* and *Achaea*, and on the habitats in which they occur.

SCHWEIZER (J.). **Jaarverslag tabak over Juli 1939 t/m Juni 1940.** [Annual Report on Tobacco from July 1939 to June 1940 inclusive.]—*Meded. Besoekisch Proefst.* no. 66 pp. 1–30. [Djember] 1940.

In the section on animal pests (pp. 25–27), brief notes are given on insects attacking tobacco and their control at the Besoeki Experiment Station, Java, in 1939–40 [*cf. R.A.E.*, A **28** 324]. The derris spray containing 0·02 per cent. rotenone again proved effective against thrips and *Myzus persicae*, Sulz. Larvae of *Prodenia litura*, F., and *Psara ambitalis*, Rebel, were very abundant on soy beans, from which they migrated to tobacco ; serious injury to the latter was prevented by clearing adjoining soy-bean plants and by using channels of running water as barriers. The control measures recommended comprise the destruction of the egg-masses, which are laid chiefly on the lower surfaces of the leaves, and spraying with lead arsenate. The Tachinid, *Podomyia setosa*, Dol., was bred from pupae of *Prodenia litura*.

VAN DER VEEN (R.). **Enkele proeven met** *Lasioderma serricorne* **Fabr. in verband met de wijze van opslaan van tabak.** [Some Experiments with *L. serricorne* in Connection with the Storing of Tobacco.]—*Meded. Besoekisch Proefst.* no. 66 pp. 31–42, 5 figs, 2 refs. [Djember] 1940. (With a Summary in English.)

An account is given of investigations in Java on the way in which stored tobacco becomes infested by *Lasioderma serricorne*, F., the life-history of which is summarised from the literature. A female lays about 30 eggs, and the egg, larval and pupal stages last 4–14, 30–60 and 10–14 days respectively, development from egg to adult being completed in 6–7 weeks in the tropics. The injury to tobacco is caused by the larvae, which also attack stored tobacco seed, rice, maize and cacao, so that tobacco sheds near storehouses containing such products are likely to become infested. As a protection against infestation, tobacco bales are kept under a muslin cover. It is rare to find adults inside the covers, but many occur on their outer surfaces. After some months, however, the bales at the top and bottom of a stack become infested and occasionally a side bale in contact with the muslin.

Various packing materials and chemical repellents tested by de Fluiter did not prevent infestation. Experiments by the author showed that the adults can gnaw their way out from the tobacco through various fabrics, but do not penetrate inwards to oviposit, even when thin muslin is used. The female can pierce the muslin with its ovipositor and thus lay an egg, either on the inner surface or directly on the tobacco. If the cover is made of stouter fabric, the beetle oviposits on its outer surface. In further experiments, it was found that the newly hatched larvae survive for a maximum of 48 hours without food and travel a total distance of about 2 ft. When the egg is deposited near but not on the tobacco, the larva reaches the tobacco by chance and not because it is guided by a sense of smell. It is able to eat its way through twill, packing paper, cellophane and sisalkraft paper ; 2 out of 20 larvae penetrated sisalkraft. The perforations are so minute that they are practically invisible. If given a choice, adults oviposit on cloth rather than on paper.

From these experiments, the author has devised a method of storing tobacco so as to protect it from infestation. The stack of bales should be enclosed in a cover of muslin. The muslin " roof " should be some inches above the tobacco and covered with paper to prevent eggs being laid upon it from which larvae can drop down to the tobacco. The sides should be at least 16 ins. away from the sides of the stack. To prevent any chance of infestation from below, the stack should be built upon a platform raised on wooden suppports 8 ins. high, and the supports should be banded with vaseline.

Insect Pests.—*Agric. Gaz. N.S.W.* **52** pt. 1 pp. 33–37, 6 figs. Sydney, 1941.

In this part of a series on insect pests in New South Wales [*cf. R.A.E.* A **29** 335], it is stated that *Aphelinus mali*, Hald., is now distributed throughout the State and exercises good control of *Eriosoma lanigerum*, Hsm., on apple, although this Aphid is often abundant in early spring [*cf.* **28** 289]. The effect on the parasite of sprays for the control of the Aphid is discussed [*cf.* **24** 119], and it is recommended that any wood or prunings that are heavily infested with Aphids should be removed before the application of winter oil sprays and retained until the parasites have emerged [**28** 289].

During the past season, several severe infestations of *Rhinaria perdix*, Pasc., were recorded on strawberry plants. Notes are given on the bionomics and control of this weevil, which causes only occasional damage in New South Wales, but is more abundant in Victoria [*cf.* **20** 325].

WALLACE (C. R.). **On the Occurrence of the Weevil** *Naupactus leucoloma* **Boh. in Australia.**—*J. Aust. Inst. agric. Sci.* **6** no. 4 pp. 209–211, 6 refs. Sydney, 1940.

An account is given of observations on the bionomics of *Pantomorus* (*Naupactus*) *leucoloma*, Boh., in New South Wales [*cf. R.A.E.*, A **21** 303], supplemented by unpublished data obtained by workers in the United States, where this weevil occurs in Florida, Louisiana, Mississippi and Alabama and is regarded as a potentially serious pest. It has been recorded from 234 species of plants in one locality in Alabama, including the main field and vegetable crops [*cf.* **28** 469, 470], but in New South Wales its principal food-plant appears to be lucerne, though vegetable crops, particularly french beans, cauliflowers and cabbages, are also attacked. Apart from one infestation on the Macleay River, the weevil has been found only in parts of the Hunter Valley and in its immediate hinterland across the Dividing Range, where it was found attacking lucerne in the autumn of 1932 and in January 1933. All these infestations lie within 110 miles of the coast, between latitudes 30° 40′ and 32° 50′ S., while the great majority of infested zones in the United States lie between latitudes 30° and 32° 30′ N.

Late-instar larvae have been found in New South Wales in all months except December and January, and as they are abundant in February, it is certain that larvae occur throughout the year. The author has observed that they are common in winter from June to September [*cf.* **26** 132], but no pupae or adults have been taken in these months. Pupae are known to occur in October, November, February and March, and adults from November to May, inclusive. It is believed that most of the adults die off with the onset of severe cold in June. Oviposition has been observed in New South Wales during May.

Observations in the United States showed that although the duration of the larval stage averages 10·7 months, some larvae that hatched in 1937 and were apparently fully grown in 1938 did not pupate in that year. Adult longevity averaged 14 weeks and ranged up to 171 days, and oviposition occurs from July to November.

ALLMAN (S. L.). **After-effects of feeding Queensland Fruit Flies on Poison Baits.**—*J. Aust. Inst. agric. Sci.* **6** no. 4 pp. 211–213, 1 ref. Sydney, 1940.

In laboratory investigations in Australia on the control of the Queensland fruit-fly [*Dacus ferrugineus tryoni*, Frogg.] by means of poisoned bait-sprays [*cf. R.A.E.*, A **29** 54, 337], considerable percentages of the flies have survived exposure to the poisons in some of the experiments. A few have survived for as long as a fortnight. During recent seasons, commercial fruit-growers have obtained satisfactory control by a bait-spray containing sodium fluosilicate and sugar, and it was therefore considered possible that flies taking sub-lethal doses of poison were rendered incapable of ovipositing, or deposited sterile eggs. To verify this, flies were taken from a series of toxicity tests and placed with apples in fresh cages containing a supply of water and sugar-peptone food. Of those that had previously fed on a bait containing tartar emetic and two containing sodium fluosilicate, 39, 52 and 64 per cent., respectively, survived, as compared with 98 per cent. in the controls. Two days after removal, breeding records were begun. The results are shown in a table, but as the numbers of sterile eggs were counted only in the case of fruits from which no adults were obtained, the figures given do not show the true proportion of sterile eggs laid. They indicate, however, that tartar emetic and sodium fluosilicate exercise some residual effect, and flies surviving tests in which these poisons are used actually deposit a number of sterile eggs. This loss in fertility is not permanent, and deposition of fertile eggs takes place after approximately one week for sodium fluosilicate and two weeks for tartar emetic. Some flies used in these experiments survived the winter, many living for at least 7 months. Eggs were deposited at irregular intervals throughout the winter and at temperatures as low as 58° F. Adults were obtained from many of the fruits infested during the winter. Approximately 30 per cent. of these winter-bred flies exhibited variations of chaetotaxy, which were presumably due to development under low temperatures and not to any residual effect of the poisons.

LEVER (R. J. A. W.). **Division of Entomology. Annual Report for 1939.**—3 pp. Suva, Dep. Agric. Fiji, 1940.

Some of the information in this account of entomological work in Fiji in 1939 has already been noticed [*R.A.E.*, A **27** 641 ; **28** 136, 323, 380 ; **29** 148, 169]. Outbreaks of *Cirphis unipuncta*, Haw., on Para grass [*Panicum barbinode*] and other grasses and of *Spodoptera mauritia*, Boisd., on rice during February–June [*cf.* **28** 323] were associated with flood conditions and were the heaviest since 1931 ; no parasites were reared, although *C. unipuncta* is known to be attacked locally by *Apanteles expulsus*, Turn. Other pests that occurred during the year included *Spilonota holotephras*, Meyr., on guava [*cf.* **28** 135] ; *Graeffea cocophaga*, Newp., on coconut, etc. ; *Epilachna vigintioctopunctata*, F., on potato ; and *Calotermes* (*Kalotermes*) *repandus*, Hill, in flooring, where it was accompanied by dry rot. The export of bananas to the United States is now permitted, provided that application is first made for a permit, since it has been shown that *Dacus* (*Strumeta*) *psidii*, Frogg., does not occur in Fiji and that *D.* (*S.*) *curvipennis*, Frogg., is very scarce and not a pest of bananas [*cf.* **27** 366]. No fruit-flies were available during the first few months of the year owing to a complete absence of fruit, and in consequence laboratory stocks of the parasites, *Tetrastichus* [*giffardianus*, Silv.] and *Syntomosphyrum* [*indicum*, Silv.], died out after 1,680 of the former and 2,250 of the latter had been released. A total of 1,825 of the Chalcid parasite, *Dirhinus* sp., was released against fruit-flies in 1938, and this figure was increased to 4,185 in 1939. In May, a consignment of *Liothrips urichi*, Karny, was sent by sea to the Solomon Islands for the control of *Clidemia hirta* ; no fresh food was provided at the end of the journey and only 15 thrips survived. A colony of the thrips appears, however, to be established in the Shortlands Island

District. A consignment sent to northern Lau arrived in good condition. All of 150 adults of *Bufo marinus* shipped to the Gilbert and Ellice Islands in November survived the journey.

Hymenopterous parasites recorded during the year included *Macrocentrus calacte*, Nixon, attacking *Argyroploce* (*Cryptophlebia*) [*illepida*, Btlr.] on ivi nut [*Inocarpus edulis*], *Chrysocharis* attacking *Phytomyza* [*spicata*, Mall.] on maize, and *Phaenocarpa leveri*, Nixon, attacking *Drosophila* and not, as previously stated, *Dacus* (*Chaetodacus*) [*passiflorae*, Frogg.] [*cf.* **28** 230, etc.].

Lever (R. J. A. W.). **Division of Entomology. Annual Report for 1940.**—2 pp. Suva, Dep. Agric. Fiji, 1941.

Much of the information in this report on insect pests in Fiji in 1940 has already been noticed [*R.A.E.*, A **29** 170, 279, 390]. Those recorded during the year included *Aphis gossypii*, Glov., on cotton; *Argyroploce* (*Cryptophlebia*) *illepida*, Btlr., on fruits of *Inocarpus* [*edulis*]; *Aeolarchis sphenotoma*, Meyr., on leaves of *Pandanus*; *Bruchus chinensis*, L., in *Cajanus* seeds; *Tribolium castaneum*, Hbst., *Oryzaephilus surinamensis*, L., *Carpophilus dimidiatus*, F., and *Calandra oryzae*, L., all in shelled ground-nuts [*Arachis hypogaea*] from Ceylon; *Sitodrepa panicea*, L., in coriander seeds and *Brevicoryne brassicae*, L., on cauliflowers, both from New South Wales; *Catorama herbarium*, Gorh., in upholstery; and *Calotermes* (*Kalotermes*) *repandus*, Hill, in furniture.

A consignment of adults of *Nezara viridula*, L., parasitised by the Tachinid, *Trichopoda pennipes*, F., was received from Florida, but only a few parasites emerged and these died without mating. A total of 34,350 laboratory-reared adults of *Dirhinus* sp. was liberated in Viti Levu against fruit-flies [*Dacus*]. Beneficial insects dispatched to other islands included the lantana bug, *Teleonemia scrupulosa*, Stål, to Western Samoa; the Histerid, *Plaesius javanus*, Erichson [predacious on *Cosmopolites sordidus*, Germ.] to Rarotonga; and *Apanteles* sp. to Honolulu, where it is being used against the corn-earworm, *Heliothis* [*armigera*, Hb.]. *T. scrupulosa* and *Liothrips urichi*, Karny, were also distributed to various islands in the Fiji group, the latter for use against *Clidemia* [*hirta*].

Christensen (J. R.). **Un nuevo enemigo de los manzanos en la Argentina,** *Typhlocyba froggatti*, **Baker.** [A new Enemy of Apple in Argentina, *T. froggatti*.]—*Rev. Soc. ent. argent.* **10** no. 3 pp. 298–301, 10 figs., 13 refs. Buenos Aires, 1940.

A description is given of the adults of both sexes of *Typhlocyba froggatti*, Baker, from material taken in the Provinces of Buenos Aires and Rio Negro, Argentina. This Jassid attacks the lower surfaces of the leaves of apple, chiefly in the shady parts of the tree. As it might prove a serious pest in nurseries and orchards, measures should be taken to prevent its being carried on infested plants or plant parts beyond its present area of distribution, which is limited by natural barriers. Injury by it could probably be prevented by a 0·2 per cent.

nicotine spray, applied twice during the period when spraying against *Cydia* (*Carpocapsa*) *pomonella*, L., is in progress.

DAGUERRE (J. B.). **Observaciones biológicas sobre** *Dichroplus arrogans* **(Stål).**—*Rev. Soc. ent. argent.* **10** no. 4 pp. 341–346. Buenos Aires, 1940.

Vast areas of the Province of Buenos Aires serve for the breeding of *Trigonophymus* (*Dichroplus*) *arrogans*, Stål, as well as of the economically less important grasshoppers, *Scyllinops variabilis*, Bruner, *T.* (*Dichroplus*) *elongatus*, Giglio-Tos, and *T. pratensis*, Bruner. *T. arrogans* often multiplies to outbreak proportions and has an extremely wide range of distribution, which extends to considerable altitudes in the mountainous parts of the Province of Mendoza [*cf. R.A.E.*, A **28** 216] and the Neuquen Territory. Since it was thought that it undertook only short local flights, the cause of such wide dispersal remained unexplained, until some swarms were observed flying at very great altitudes.

Flights occur during the day, and swarms are carried by favourable winds for great distances. This may account for the sudden appearances of adult grasshoppers in areas where no hatchings were observed. Flights in Buenos Aires Province were usually directed from east to west. The reasons for the excessive multiplication of *T. arrogans* are ecological. Its natural habitat is in inundation plains round lakes and in river valleys, and the recent drainage of large areas has resulted in an extension of this type of habitat, and in a reduction in the numbers of water-fowl that feed on grasshoppers. In addition, the cultivation of lucerne has created particularly favourable conditions by providing abundant green food, even in the dry season. Years with abundant rainfall are unfavourable to grasshoppers, because flooding, although it does not kill the eggs, delays their hatching, while many eggs are destroyed by livestock trampling them down into moist soil. Dry years favour outbreaks, because suitable areas increase through the drying out of lakes, while the number of water birds is reduced, and eggs in dry hard soil are not affected by the trampling of livestock; in addition, poor vegetation cover enables solar rays to reach the soil and the insects, and this accelerates their development, and increases fertility, while reducing fungous diseases. The necessity for further studies of the bionomics of grasshoppers is emphasised.

GEMIGNANI (E. V.) & RODRÍGUEZ (R.). **Daños causados a las maderas por el** *Hylotrupes bajulus* **(L.).** [Injury to Timber by *H. bajulus*.]—*Rev. Soc. ent. argent.* **10** no. 4 pp. 370–378, 1 pl., many refs. Buenos Aires, 1940.

A case is recorded of injury to a wooden floor in a house in Buenos Aires by *Hylotrupes bajulus*, L., and it is stated that damage by it is common in houses there and that it was introduced into Argentina in pine battens. Instances of infestation observed in France are cited as evidence of the injuriousness of this Cerambycid. Descriptions are given of the genus *Hylotrupes* and of the adult of *H. bajulus*, with a list of its subspecies and varieties. There are two other existing species in the genus, *H. amethystinus*, Lec., and *H. bifasciatus*, Motsch., and a fossil.

Hayward (K. J.). **La " lagarta rosada " del algodonero** (*Pectinophora gossypiella* **Saunders**). [The Pink Boll Worm of Cotton, *Platyedra gossypiella*, Saunders.]—*Circ. Estac. exp. agríc. Tucumán* no. 93, 9 pp., 5 figs., 4 refs. Tucumán, 1940.

A brief account is given of the bionomics, distribution and control of *Platyedra* (*Pectinophora*) *gossypiella*, Saund. This Tineid already occurs in Argentina but has not yet spread to the Province of Tucumán, where much cotton is grown. Unceasing vigilance will be needed to prevent its entry.

Ward (J. F.). **Locusts.**—*Gaz. Extraord. Brit. Honduras* 1941 no. 33 p. 237. Belize, 1941.

Large swarms of flying locusts [*Schistocerca paranensis*, Burm.], reported to have come from Yucatan, appeared in the northern part of British Honduras at the end of May 1941 and gradually spread southwards. It is recommended that swarms should be prevented from settling on or near crops by beating drums, cans, etc., and by the use of smoke-screens, that eggs should be destroyed by being dug up, and hoppers controlled by the use of trenches and barriers of sheet iron.

Gómez-Menor Ortega (J.). **Cóccidos de la República Dominicana (Hem. Cócc.).**—*Eos* **16** (1940) pp. 125–143, 4 figs., 13 refs. Madrid, 1941.

A list, based on the literature and original observations, is given of 54 species of Coccids that occur in the Dominican Republic, showing their food-plants and local distribution, and including descriptions of the larva and adult female of one species recently described by the author [*R.A.E.*, A **24** 127]. The species of economic importance are *Aulacaspis pentagona*, Targ., on papaya, *Prontaspis* (*Chionaspis*) *citri*, Comst., *Lepidosaphes beckii*, Newm., and *Saissetia oleae*, Bern., on *Citrus*, *Coccus viridis*, Green, on *Citrus* and coffee, *S. coffeae*, Wlk. (*hemisphaerica*, Targ.) on *Citrus*, coffee and other crops, *Icerya purchasi*, Mask., on *Citrus* and *Casuarina*, *Chrysomphalus ficus*, Ashm. (*aonidum*, auct.) on *Citrus* and coconut, *Aspidiotus destructor*, Sign., on coconut, *Pinnaspis* (*Hemichionaspis*) *minor*, Mask., on cotton, *Lepidosaphes alba*, Ckll., on cassava, *Pseudococcus brevipes*, Ckll., on pineapple, *P. citri*, Risso, on cacao, and *Trionymus sacchari*, Ckll., on sugar-cane.

Natural enemies that have been introduced comprise *Pentilia castanea*, Muls., and *Cryptognatha nodiceps*, Mshl., from Porto Rico against *Aspidiotus destructor* [**26** 10], *Rodolia* (*Vedalia*) *cardinalis*, Muls., against *Icerya purchasi*, *Cryptolaemus montrouzieri*, Muls., against *Pseudococcus* spp., and the Encyrtid, *Leptomastidea abnormis*, Gir., against *Pseudococcus citri*.

Service and Regulatory Announcements, July-September, 1940.—*S.R.A., B.E.P.Q.* no. 144 pp. 65–83. Washington, D.C., U.S. Dep. Agric., 1940.

Experience in the treatment of plants in the field with carbon bisulphide emulsion against the Japanese beetle [*Popillia japonica*, Newm.] in the United States has shown that the existing requirement that soil be undisturbed for 48 hours after the completion of the treatment

[*R.A.E.*, A **20** 681] is unnecessary. Announcements relating to Quarantine no. 48 against *P. japonica* include Administrative Instructions (B.E.P.Q. 499 supplement no. 3) modifying the required treatment accordingly. Administrative Instructions (B.E.P.Q. 499 supplement no. 1 second revision) authorise the fumigation with methyl bromide by a method already described [*cf.* **27** 591 ; **28** 490, 610] of plants with bare roots or roots in 12-inch pots or soil balls at a dosage of 2 lb. methyl bromide per 1,000 cu. ft. for a period of 2½ hours at 70°F.

Administrative Instructions (B.E.P.Q. 510) relating to Quarantine no. 13 against the Mediterranean fruit-fly [*Ceratitis capitata*, Wied.] and the melon fly [*Dacus cucurbitae*, Coq.] authorise the movement from the Territory of Hawaii into or through any State, Territory or District of the United States of guavas, papayas, bell peppers [*Capsicum*], bitter melon, cucumber, summer squash, string beans and tomatos, provided that they have been fumigated under supervision with methyl bromide at the rate of 2 lb. per 1,000 cu. ft. for 3½ hours at a temperature not lower than 80°F. The fumigation chamber must be lined with sheet metal, with locked and soldered seams, and fitted with a tight metal-clad door closing against gaskets rendering it gas-tight at ordinary atmospheric pressures, and must be equipped with a blower-type fan having a capacity of at least one-third the volume of the room per minute. The fan must be operated throughout the period of exposure, and when fumigation is completed fresh air must be drawn over and through the load for at least 20 minutes. The operator should wear a gas-mask. In connection with these requirements, it is pointed out by L. A. Strong that the palatability of papayas and tomatos is unimpaired by fumigation, but information on its possible effect on guavas, bell peppers, bitter melons, summer squash and string beans under the conditions prevailing in Hawaii is not available ; data obtained in experimental work elsewhere indicate that the fumigation of cucumbers with methyl bromide at rates lower than those authorised for use in Hawaii may result in severe injury.

Other information in this part includes summaries of plant quarantine restrictions in Iraq and Uruguay.

BLAKE (C. H.). **Ants preying on Termites (Hymen. : Formicidae ; Isoptera : Rhinotermitidae).**—*Ent. News* **52** no. 2 p. 38. Philadelphia, Pa., 1941.

The only recorded instance of the capture of swarming termites by ants in North America appears to be of an unnamed species taken by *Iridomyrmex humilis*, Mayr, in Louisiana. The author gives a list of six species of ants of other genera that he observed taking alates of *Reticulitermes flavipes*, Kollar, in Massachusetts in the spring of 1940, and quotes a summary by Wheeler of the ecological relations of ants to termites.

THOMAS (F. L.) & others. **Entomology.**—*Rep. Texas agric. Exp. Sta.* **52** (1938–39) pp. 51–62. College Station, Texas, 1940.

This report comprises a survey of work carried out on insect pests in Texas in 1939, particularly the usual pests of cotton. Other insects that were injurious during the year included *Chlorochroa ligata*, Say, which bcame very abundant on flax in various areas. This Pentatomid is a pest of cotton and other crops in the arid and semi-arid areas of the south-western United States and may become a major pest of flax, particularly where mesquite [*Prosopis*] is also present. Preliminary experiments showed that it is capable of delaying the production of flax and reducing the quantity and quality of the seed. It overwinters in the adult stage, and requires about a month for development from egg to adult. The females lay 1–3 clusters of about 40 eggs each. The Tachinid, *Gymnosoma fuliginosum*, R.-D., which parasitises 10–20 per cent. of the nymphs and adults in June, and an unidentified Hymenopterous parasite that destroyed approximately 30 per cent. of the eggs during May are important in controlling the bug in summer.

BLACK (L. M.). **Hereditary Variation in the Ability of the Clover Leaf Hopper to transmit Potato Yellow-dwarf Virus.** (Abstract.)—*Phytopathology* **31** no. 1 p. 3. Lancaster, Pa., 1941.

By selective breeding through ten generations, two races of the clover leafhopper, *Aceratagallia sanguinolenta*, Prov., were obtained, one " active," the other " inactive." In conditions under which 80 per cent. of the active individuals transmitted the potato yellow-dwarf virus (*Marmor vastans*) to crimson clover (*Trifolium incarnatum*), only 2 per cent. of the inactive individuals and 30 per cent. of the hybrids between the two races did so. Infective individuals appeared in colonies of the inactive race, although all their ancestors for ten generations had failed to transmit. Conversely, in colonies of the active race some insects failed to transmit, despite the fact that all their ancestors for ten generations were infective. Infective insects in the active race were more efficient vectors (efficiency coefficient=0·68) than infective insects in the inactive race (e.c.=0·53). Male infective insects were slightly but significantly more efficient vectors (e.c.=0·68) than female infective insects (e.c.=0·64). A slightly but significantly higher percentage of males (43) than females (38) transmitted the virus. Tests with the hybrids indicated that sex-linkage may be involved in the heredity of ability to transmit.

CHARLES (V. K.), COUCH (J. N.), HARRAR (J. G.) & MCKELVEY jr. (J. J.). **A fungous Parasite of the Mealy Bug.** (Abstract.)—*Phytopathology* **31** no. 1 p. 5. Lancaster, Pa., 1941.

In August 1939, some examples of *Pseudococcus comstocki*, Kuw., that appeared to have been killed by a fungus were found in Virginia. Attempts to isolate the fungus were unsuccessful, and similar material was not found again till August 1940, when nearly all the adult mealybugs in orchards near Roanoke were killed. From such mealybugs was isolated a fungus, pathogenic for the species and apparently undescribed. The pathogen was re-isolated from mealybugs killed by it in the laboratory. The potentialities of this fungus in the biological control of *P. comstocki* are being investigated.

FREITAG (J. H.). **A Comparison of the Transmission of four Cucurbit Viruses by Cucumber Beetles and by Aphids.** (Abstract.)—*Phytopathology* **31** no. 1 p. 8. Lancaster, Pa., 1941.

The results are given of a study of insect transmission of four viruses of cucurbits that occur in California. The virus of squash mosaic was readily transmitted by *Diabrotica trivittata*, Mann., and *D. soror*, Lec., but infrequently by Aphids, only 5 of 8 species tested transmitting the virus and to only 13 of 245 plants. The virus of ring mosaic of cucurbits was transmitted by both beetles, but not by Aphids. The virus causing mosaic of wild cucumber (*Echinocystis fabacea*) was transmitted by *D. trivittata* to 5 of 32 squash plants, but 9 species of Aphids failed to infect 255 squash plants. The virus of western cucumber mosaic was transmitted to only 1 of 61 squash plants by *D. trivittata* and not at all by *D. soror*, but 10 species of Aphids readily transmitted it to 104 of 271 squash plants.

FREITAG (J. H.). **Insect Transmission, Host Range and Properties of Squash-Mosaic Virus.** (Abstract.)—*Phytopathology* **31** no. 1 p. 8. Lancaster, Pa., 1941.

Tests showed that *Diabrotica trivittata*, Mann., is a more effective vector than *D. soror*, Lec., of the virus of squash mosaic. When ten beetles were transferred to each squash plant for a period of 1 day, *D. trivittata* infected 23 of 25 plants and *D. soror* 8 of 25. Single examples infected 19 of 30 and 2 of 25, respectively. Examples of *D. trivittata* fed on diseased plants for several days and then daily on successive healthy ones remained infective for 10 days. In studies of host range, the virus has been transmitted to, and recovered from, 15 species of plants in 11 genera belonging to 4 families.

GIDDINGS (N. J.). **Strain Combinations of Curly-top Virus.** (Abstract.)—*Phytopathology* **31** no. 1 p. 8. Lancaster, Pa., 1941.

In the course of investigations on the infection of sugar-beet plants with combinations among 7 different strains of the virus of curly-top, it was found that at least 3 strains of virus can be carried simultaneously by one leafhopper [*Eutettix tenellus*, Baker] and that daily transfers of such an insect might give consecutively 3 infested plants, each expressing typical symptoms of a different strain of the virus.

GRANOVSKY (A. A.) & PETERSON (A. G.). **The Role of Insects in the Pit Scab of Potatoes.** (Abstract.)—*Phytopathology* **31** no. 1 pp. 9–10. Lancaster, Pa., 1941.

Pit scab of potatoes resembles insect lesions the borders of which are lined with infection by scab (*Actinomyces scabies*), but weekly examinations from planting date to harvest show only a few pit-scab lesions infested with insects. Infection takes place primarily through lenticels without the aid of insect injury. The tissue in scab pustules absorbs and holds moisture, prevents formation of effective wound cork and provides a suitable medium for secondary saprophytic organisms, especially bacteria. Several forms of soil microfauna invade, chiefly as scavengers, scab pits caused by secondary decay, especially mites, certain species of Collembola and occasionally *Sciara pauciseta*, Felt. Mites are apparently effective vectors of saprophytic bacterial organisms.

Rankin (W. H.), Parker (K. G.) & Collins (D. L.). **Dutch Elm Disease Fungus prevalent in Bark-beetle-infested Elm Wood.** (Abstract.)—*Phytopathology* **31** no. 1 p. 19. Lancaster, Pa., 1941.

Samples of elm wood infested by the hibernating brood of *Scolytus multistriatus*, Marsh., were collected in New York State over an area of about 3,000 square miles in which Dutch elm disease, caused by *Ophiostoma* (*Ceratostomella*) *ulmi*, has existed for at least two years. By daily culturing of a fraction of the adults that emerged, beetles carrying the fungus were obtained from 59 of the 154 samples taken. The samples were representative of over 100,000 dead and dying elms and additional elm wood on the ground found during the previous year at over 30,000 places in the same area. The average annual incidence of elms found dying of the disease in this area is only about 1 in 3 square miles. This proof of the prevalence of sources of infection and the low incidence of elms killed by the fungus seems to indicate either a low efficiency for the beetle as an agent of infection, or a critical balance requisite for infection that is rarely satisfied.

Black (L. M.). **Further Evidence for Multiplication of the Aster-Yellows Virus in the Aster Leaf Hopper.**—*Phytopathology* **31** no. 2 pp. 120–135, 19 refs. Lancaster, Pa., 1941.

Details are given of the technique and results of experiments showing that the virus of aster yellows (*Chlorogenus callistephi* var. *vulgaris*) can be mechanically transmitted to uninfected examples of the aster leafhopper [*Macrosteles divisus*, Uhl.] by inoculation of the juice (macerated pulp) of infected ones, used alone or diluted with 0·85 per cent. saline solution [*cf. R.A.E.*, A **21** 486], and that the virus undergoes an incubation period in the leafhopper.

The following is substantially the author's summary. The juice was infective at dilutions as great as 10^{-2}, and the virus underwent a minimum incubation period of 11–45 days in the inoculated insects. Once they began to transmit it they usually did so until they died. Mechanical transmission of the virus to them was more effective at 0°C. [32°F.] than at 25°C. [77°F.]. Freezing viruliferous leafhoppers for 20 minutes at −10°C. [14°F.] destroyed most of the virus. Most of the virus was inactivated by storage for 24 hours at 0°C. in insect juice diluted to $10^{-1 \cdot 5}$. Experimental evidence was obtained indicating that the virus multiplied at least 100 fold in the insects between the second and twelfth day of a 17-day incubation period. It reached a high concentration in the insects 6 days before they transmitted it to asters. There is some evidence of a decrease in concentration of the virus towards the end of the incubation period.

McLean (D. M.). **Studies on Mosaic of Cowpeas,** *Vigna sinensis*.—*Phytopathology* **31** no. 5 pp. 420–430, 1 fig., 20 refs. Lancaster, Pa., 1941.

The following is based largely on the author's summary : The mosaic disease of cowpeas (*Vigna sinensis*) was first recorded from Arkansas in 1921 and has since been reported in Indiana, Lousiana, Oklahoma, Georgia, Mississippi, Iowa, Kansas and New Jersey. Experiments on the properties and methods of transmission of the virus, its host-range and the susceptibility to it of varieties of cowpeas were carried out during 1938–40 in Ohio with plants grown from infected seed from Oklahoma. The symptoms included dwarfed slender growth with a tendency towards excessive branching, and were most strikingly developed in the highly susceptible varieties. The virus can be transmitted by ordinary manual methods of inoculation, although not with unfailing regularity ; vigorously growing plants exhibit the symptoms more quickly than slowly growing ones. About 5 per cent. of the seed from highly susceptible varieties commonly contains the virus. It was transmitted in preliminary tests by *Myzus persicae*, Sulz., and *Macrosiphum solanifolii*, Ashm., and subsequently by *Aphis gossypii*, Glov., an undetermined black Aphid and *Macrosiphum onobrychis*, Boy. (*pisi*, Kalt.), which were the common Aphids on cowpeas in nature and infected 100, 100 and 70 per cent., respectively, of the plants on which they were tested. It was not transmitted by *Empoasca fabae*, Harr., *Lygus pratensis*, L., *Epilachna varivestis*, Muls. (*corrupta*, Muls.), or *Diabrotica melanocephala*, F. (*vittata*, F.). C. E. Smith reported that cowpea mosaic is transmitted by *Cerotoma trifurcata*, Forst. [*R.A.E.*, A **12** 500], but extensive observations on cowpeas in Oklahoma in 1938 and on beans and cowpeas in Ohio in 1939 indicated that this Galerucid does not habitually feed on cowpeas in large numbers in these regions and so is unlikely to be of importance in spreading the disease. The relation of the virus of cowpea mosaic to several common viruses is discussed ; it was transmitted to Lima bean (*Phaseolus lunatus macrocarpus*) by manual inoculation and by *M. onobrychis*, but attempts to infect other leguminous plants (including species of *Phaseolus*), solanaceous plants and cucumber were unsuccessful.

ANDERSON (L. D.) & WALKER (H. G.). **Results of a Nine Year Study of Potato Flea-beetle Control in eastern Virginia.**—*Trans. Peninsula hort. Soc.* 1940 pp. 17–24, 3 figs., 6 refs. Dover, Del. [1941.]

This paper comprises a brief review of studies during 1932–40, some of the results of which have already been noticed [*R.A.E.*, A **22** 278 ; **25** 567], on the bionomics and control of *Epitrix cucumeris*, Harr., on the Eastern Shore of Virginia, where it is an important pest of potato. The adults generally feed on the lower surface of the leaves, causing the formation of small holes ; damage to the roots and developing tubers by the larvae appears to be more severe in light sandy soils than in heavier ones, and severe foliage injury is not always accompanied by severe tuber injury. The adults overwinter in the soil or under débris in protected places in the field, especially on the edges of woods ; they emerge in the second half of April, feed on what few weeds and cultivated plants are available, and move to the new potato plants as soon as these appear. Oviposition begins about the first week in May, the eggs being deposited in the soil at the base of the plants. The egg, larval and pupal stages last 4–14, 13–16 and 11–13 days, respectively, and, in the nine seasons during which observations were made, peak emergence of new adults occurred between 15th and 25th June.

As a result of the experiments on control, a spray containing 2 lb. calcium arsenate, 4 lb. copper sulphate and 6 lb. hydrated lime in 50 U.S. gals. water applied at the rate of 100 U.S. gals. per acre with a sprayer having three nozzles to the row and able to maintain a pressure of at least 250 lb. per square inch is recommended for the control of

E. cucumeris in eastern Virginia [*cf.* **25** 568]. Care should be taken to time the applications so that the plants are thoroughly covered when the adults of the first generation appear between 15th and 25th June, and to adjust the nozzles to give good coverage of the lower surface of the leaves. This spray increased the yield nearly twice as much as a dust of calcium arsenate, monohydrated copper sulphate and hydrated lime (25 : 20 : 55), the use of which was profitable, however, and is recommended if spraying is impracticable.

Walker (H. G.) & Anderson (L. D.). **Results of Tests for the Control of the Pea Aphid in eastern Virginia.**—*Trans. Peninsula hort. Soc.* 1940 pp. 30–35, 8 refs. Dover, Del. [1941.]

Experiments on the control of the Aphid [*Macrosiphum onobrychis*, Boy.] on peas in eastern Virginia during 1937–40 are described [*cf. R.A.E.*, A **28** 173 ; **29** 249], and recommendations based on them are summarised. Vaporised nicotine applied by means of a standard vaporiser gave excellent control throughout the period of investigation and was more widely used commercially than any other treatment. Dusts containing derris or cubé with talc gave very variable results, but in general were most effective when applied on cloudy days, late in the evening, or at night. The dust should contain 0·75–1·0 per cent. rotenone and should be applied at the rate of 35–40 lb. per acre at a time when the wind velocity does not exceed 8 miles per hour. The addition of wetting or conditioning agents, such as 1 per cent. Vatsol O.S. or a ground-nut oil mixture [**29** 353], was sometimes of value. The duster boom should be completely enclosed, and a trailer, 25 ft. or more in length, should be attached to confine the dust round the plants for as long as possible. Nicotine dusts containing 3–4 per cent. nicotine gave good results when properly applied on a calm warm day, but weather conditions in eastern Virginia are not often favourable for this treatment. Derris sprays containing a suitable wetting agent gave adequate control of Aphids with which they came into contact, but good coverage of large plants is difficult with the equipment available in the pea-growing area of Virginia. Atomised oils containing rotenone or nicotine gave unsatisfactory results, but indications were obtained that these sprays destroy a large percentage of the Aphids with which they come into contact, and, with the development of a nozzle that would give adequate coverage, might show considerable promise. Work on control by means of insecticides applied from aircraft was limited, but the results were unsatisfactory.

Cory (E. N.). **New Developments in Insect Damage in Maryland.**—*Trans. Peninsula hort. Soc.* 1940 pp. 103–104. Dover, Del. [1941.]

Methods employed in the campaign against the Japanese beetle [*Popillia japonica*, Newm.] in Maryland during 1940 comprised the use of traps, of which 127,000 captured about 295 tons of adults [*cf. R.A.E.*, A **28** 521 ; **29** 125–126], the distribution of a dust of talc containing spores of the bacteria that cause milky disease of the larvae, and the building up, by laboratory rearing, of a stock of the larval parasite, *Tiphia vernalis*, Rohw. The bacterial spores were cultured by a method already described [**29** 125], and over 8,000 lb. of the diluted spore dust was distributed. In experimental one-acre plots that each received some 75 thousand million spores, the percentage larval mortality due to the disease reached 50–80. In heavily infested areas, three plots were established to each square mile. Over 75,000 eggs of *T. vernalis* were deposited in the laboratory and the resulting adults placed in storage for liberation in May 1941.

The European corn borer [*Pyrausta nubilalis*, Hb.] first occurred in Maryland (on the Eastern Shore) in 1930 but caused no serious damage until 1940, when entire fields of maize were almost destroyed by it. The hot weather usual in June, when first-generation eggs are hatching, probably destroyed many young larvae in previous years, but in 1940, the weather in June was cool, and many larvae survived. On the lower Eastern Shore, late planted maize was less severely damaged than earlier plantings, and some hybrids appeared to be somewhat resistant. Most of the borers in maize fodder can possibly be destroyed by low cutting, shredding, ensiling or pound feeding. The usual practice on the Eastern Shore of stripping the tops and blades of maize and allowing the stalks to stand for several years favours the survival of large numbers of *P. nubilalis*. Clean ploughing to turn the stubble under completely appears to be the most effective method of control, provided that it is general throughout the district.

JONES (E. T.). **A Discussion of Hessian Fly Resistance in certain Wheat Varieties.**—*Trans. Kans. Acad. Sci.* **43** pp. 243–265, 7 pls., 5 refs. Topeka, Kans., 1940.

An account is given of investigations during 12 years in Kansas on factors affecting the resistance of wheat to attack by the Hessian fly [*Mayetiola destructor*, Say]. Observations on susceptible and resistant varieties of winter wheat in 1927 showed that in general the numbers of eggs producing larvae that reached the feeding areas on the plants did not vary greatly, but that a smaller proportion of red, or migratory, larvae developed into white larvae and puparia on resistant than on susceptible varieties. Since the proportions of white larvae that developed into puparia were about equal, the migratory stage is apparently the susceptible one. The work further indicated that the death or abnormal development of the larvae in resistant varieties is due to the greater pressure and rigidity of the tissues in them as compared with the susceptible ones. Resistance was influenced by soil moisture, a deficiency in which tends to have a stiffening effect on the growth of the plants, causing a hardening and tightening of the leaf sheaths, which exert a fatal pressure on the larvae.

MILLER (H. D. O.). **Observations on Sod Webworms** (*Crambus* **spp. Lepidoptera**) **in Kansas.**—*Trans. Kans. Acad. Sci.* **43** pp. 267–281, 2 pls., 26 refs. Topeka, Kans., 1940.

A list is given of 17 species of *Crambus* that have been recorded in Kansas, together with an account of preliminary observations on the bionomics of 5 species, of which the adults were taken at light in 1938 and 1939. The females oviposited, but attempts to rear the larvae on various grasses were unsuccessful, as only two individuals survived to reach the adult stage. Ten adults of the Ichneumonid, *Lissonota frigida*, Cress., were reared from prepupal cases of *C. vulvivagellus*, Clem., collected in the field; the larvae pupated in the host cocoons. Considerable numbers of the Mecopterous predator, *Bittacus occidentalis*, Wlk., were observed taking adults of *C. vulvivagellus* at lights; they seemed to prefer them to other insects present. The literature on the control of larvae of *Crambus*, chiefly as pests of grass, is briefly reviewed.

WALKDEN (H. H.). **Seasonal Variation in Resistance to High Temperature of the Cadelle and the Confused Flour Beetle.**—*Trans. Kans. Acad. Sci.* **43** pp. 283–288, 4 graphs, 1 ref. Topeka, Kans., 1940.

In the course of work in Kansas on the effect of high temperatures on insects that infest stored grain and cereal products, it was observed that the resistance of larvae and adults of *Tenebroides mauritanicus*, L., was higher in autumn than in summer. Unlike most of the pests of stored grain and flour, *T. mauritanicus* normally hibernates; apparently its physiological condition changes with the approach of the lower temperatures at which hibernation occurs, thus inducing also a resistance to heat. Exposure for 15 minutes to 120°F. killed 100 and 90 per cent. of the adults and larvae, respectively, tested in mid-August, but these percentages fell to 40 and 34 for insects from the same source tested a fortnight later and to 22 and 10 after a month. In further tests, begun on 21st October, some larvae from the same source were kept at a constant temperature of 50°F. and others at 60–70°F. Samples of 30 larvae were taken from each environment at intervals of 3–7 days during the next 6 weeks and subjected for 60 minutes to a temperature of 120°F. This exposure gave complete mortality at the beginning of the experiment, but killed only 53 and 10 per cent. of larvae from the two lots, respectively, at the end. Similar experiments were carried out with larvae and adults of *Tribolium confusum*, Duv., which does not hibernate, and though there was considerable variation from month to month in resistance to heat, there was no consistent increase with the approach of cold weather.

It is considered that the variations in resistance to heat shown by these two species may partly explain the variable reaction of insects to control measures. They do not, however, affect the action of temperatures high enough to cause rapid coagulation of the proteids, and experiments showed that a temperature of 140°F. is lethal to insect pests of stored products at all times of the year.

WINBURN (T. F.). **Insect Infestation in Farm-stored Grain in Kansas.**—*Trans. Kans. Acad. Sci.* **43** pp. 289–290. Topeka, Kans., 1940.

In view of the increased abundance of insect pests in grain stored on farms in Kansas in 1939, an examination was made in November of 27 bins of wheat selected at random in one county. Of these 25 were found infested, and the numbers and species of insects taken in standard samples are shown in a table. Insects found infesting wheat in bins in another county included the Tenebrionids, *Tenebrio picipes*, Hbst., and *Cynaeus angustus*, Lec., both of which were numerous in one wheat bin. *T. picipes* has previously been recorded from stored cereals in the United States and Japan, but the only similar record for *C. angustus* is of adults from a flour mill in Washington State.

Graham (S. A.) & Orr (L. W.). **The Spruce Budworm in Minnesota.**—*Tech. Bull. Minn. agric. Exp. Sta.* no. 142, 27 pp., 6 figs., 4 refs. St. Paul, Minn., 1940.

Outbreaks of the spruce budworm, *Harmologa* (*Cacoecia*) *fumiferana*, Clem., occur in coniferous forests in Minnesota at intervals of 40–70 years, which is the period required for a generation of balsam fir [*Abies balsamea*], its preferred food-plant, to reach a dominant position in the forest stands. The last series of outbreaks began in 1912, and its course is briefly outlined [*cf. R.A.E.*, A **17** 516]. In some localities in which outbreaks have been most severe, practically all the balsam fir and much spruce have been killed either by defoliation or wind-throw following the opening of the forest after budworm attack. Although from the point of view of timber management, *A. balsamea* is not a valuable timber, it is now in demand for pulpwood, and such an outbreak at present would result in serious economic loss.

The bionomics of *H. fumiferana* are similar to those of the biological race of the species that attacks pine [*cf.* **23** 698]. Outbreaks of the form that attacks fir and spruce invariably arise in areas in which the forest is predominantly balsam fir that averages 4 inches or more in diameter. Young stands of fir or spruce and trees overtopped by aspen, birch or pine are seldom severely defoliated even during an outbreak in adjacent stands. The tremendous potential rate of multiplication (a single female deposits over 360 eggs) is sufficient to account for the fact that the budworm may build up from a scattered population to outbreak proportions within two or three years. After three successive years of defoliation, the fir trees begin to die rapidly. Spruce is usually less severely defoliated and is likely to survive longer. Complete defoliation would kill either fir or spruce in a single season, but the larvae feed mainly on the foliage of the current year, especially on spruce, and for this reason the trees can survive several years of injury. Each year they produce less foliage, while the budworm population increases until starvation, together with the activities of parasites and predacious animals, almost exterminates it. After this, it does not assume outbreak proportions again for many years. For several years following defoliation the trees that are very severely injured continue to die, but the others recover unless they are attacked by secondary organisms such as bark-beetles or fungi [*cf.* **13** 194]. The damage greatly increases the danger of wind-throw and fire, and counts of reproduction on sample areas from 1925 to 1937 suggest that, where fire has not followed the outbreak, there will be a larger proportion of *A. balsamea* in the developing tree generation than in the original stands.

As there are numerous instances of forests with a composition favourable to rapid budworm multiplication that are not attacked, it appears that other favourable factors must also be present to bring about an outbreak. It is known that severe mortality of insectivorous birds due to intense periods of cold preceded the outbreak in Minnesota in 1912. A similar reduction in the number of predacious or parasitic insects, or a series of years in which weather conditions are particularly favourable to the budworm, might have a similar effect. Once it starts to increase, its high fecundity carries it beyond the possibility of immediate control by animals with a lower reproductive capacity. Under normal conditions, the ratio of birds to the larvae on which they feed is favourable for control.

Extensive spraying or dusting for budworm control has proved expensive and only partly effective, and in forests in which commercial timber is produced, silvicultural methods are the most promising. Balsam fir should be grown in as short a rotation period as possible, and should not be allowed to occupy a predominant position in the upper crown canopy over extensive areas. Where it comprises a considerable portion of the stand and it is not desirable to eliminate it, the danger of budworm outbreak may be materially reduced by appropriate logging. Efforts should be made to prevent its becoming established in stands from which it is now absent. Sporadic outbreaks may occur over small favourable areas, but disastrous outbreaks are invariably associated with extensive areas of susceptible forest types.

STEARNS (L. A.). **European Corn Borer in Delaware. Present Infestation—Seasonal Development and Feeding Habits—Control Possibilities.**—*Trans. Peninsula hort. Soc.* 1940 pp. 110–119, 4 figs., 9 refs. Dover, Del. [1941.]

Records are given showing that infestation of maize by the European corn borer [*Pyrausta nubilalis*, Hb.] in Delaware increased gradually from 1934, when it was first recorded in the State, until 1939, and sharply in 1940 [*cf. R.A.E.*, A **29** 505] when the average percentage of plants infested was 19·1 as compared with 4·1 in the preceding year. One instance of severe infestation of potatoes was observed in October 1938. As it appears that the moth will be of periodical importance in Delaware, where it probably has two generations a year, a review is given of information on its feeding habits, seasonal history and control in other parts of the infested area in the United States.

DOWNES (W.) & ANDISON (H.). **Notes on the Life History of the June Beetle** *Polyphylla perversa* **Casey.**—*Proc. ent. Soc. B. C.* no. 37 pp. 5–8, 1 ref. Vernon, B.C., 1941.

Larvae of the Melolonthid, *Polyphylla perversa*, Csy., have long been known as sporadically important pests of small fruits grown on light sandy soil in most parts of southern Vancouver Island, and losses due to them have recently become general. They were formerly considered to be mainly pests of strawberries, but recent evidence indicates that throughout the greater part of their life they cause considerable injury to the roots of other crops on light soil, particularly nursery stock of rose, apple, pear, plum and cherry. In one case the growing of nursery stock had to be abandoned. Loganberries and raspberries are also attacked. Potatoes are often seriously injured when planted on infested land, the larvae scooping out large cavities in the tubers. Maize is also attacked, a single larva often cutting off the roots of several plants. When the larvae are deprived of their preferred food by the planting of another crop, they usually feed on the latter just as readily, except on leguminous plants, which are apparently not attractive to them. The most severe damage seems to be caused by the second- and third-year larvae. In strawberry fields, the main root of a plant may be severed 2–4 ins. below the surface of the soil, or the main fibrous roots eaten away. In heavily infested localities, one-third of the strawberry plants are sometimes killed in a single season.

The larvae occur only in light sandy or gravelly soils with a permeable subsoil. Only large or nearly mature larvae are found in the first 6–8 ins. of soil ; the larval stage almost certainly lasts 3–4 years, and the smaller larvae apparently occur deeper in the soil, where the finer and more tender roots extend. In 1940, numbers of one-year-old larvae were found at a depth of more than a foot, and it seems probable that first-year larvae occur below plough level, since eggs are deposited at depths of 8–15 ins. The larvae move deeper during December and January and have been found at a depth of 30 ins. Apart from these seasonal movements, some large larvae occur at considerable depths at all times of the year, their movements being influenced by the presence of suitable food, but from February onwards and throughout the summer they are generally near the surface, and are most noticeable during spring ploughing. Pupation begins about the middle of May and the pupal stage apparently lasts about five weeks ; most of the pupal cells occur about 4 ins. below the surface.

The beetles begin to emerge from the soil during the first week in July, or a fortnight sooner in early seasons. They flew little if at all when temperatures were below 54°F. at 8.30 p.m. but were very active at higher ones and especially at 60°F. or over. The flights continue from about 8.30 to 9.0 p.m., though some beetles are attracted to lights until 10 p.m. A light-trap, which is described, caught comparatively few of the beetles attracted to it, and most of those caught were males. Females were not obtained until males had been in flight for several days. The beetles feed on the foliage of conifers. In captivity, they fed on Douglas fir [*Pseudotsuga taxifolia*], Norway spruce [*Picea abies*], and western hemlock [*Tsuga heterophylla*], showing a preference for the last ; they accepted lodgepole pine [*Pinus contorta*] only when compelled by hunger. Elytra of the beetles were found in considerable numbers under Douglas fir and hemlock on the edge of clearings, where owls and bats had caught them as they fed. Adults survived for about three weeks in captivity, and as the flights diminished early in August, the duration of adult life is possibly not more than four or five weeks.

In 1939, it was observed that the females were most active in oviposition on warm evenings. On alighting on the soil they rapidly descend to the desired depth and then burrow horizontally, depositing eggs. Not more than 15 eggs were observed in one place, the usual number being 8–12. Dissection of gravid females indicated a laying capacity of 60–70 eggs. The incubation period was about 54 days.

Many adults were parasitised by *Sarcophaga exuberans*, Pand. ; *Muscina assimilis*, Fall., and *M. stabulans*, Fall., were also reared from the adults, but are probably scavengers. Parasitism of the larvae by *Tiphia* sp. was considerable, numerous cocoons of this Scoliid being found in infested soil. When ploughing is in progress, gulls and crows destroy great numbers of larvae. Fowls also feed on them, and if pigs are kept in infested fields, they root up the soil and devour most of the larvae that are not too deeply buried.

Memoria de la Estación experimental agrícola de La Molina correspondiente al año 1939. [Report of the Agricultural Experiment Station at La Molina for the Year 1939.]—*Mem. Estac. exp. agríc. Minist. Fom. Peru* no. 12, xxiv+371 pp., illus. Lima, 1940.

This report includes a section (pp. 177–210) by J. E. Wille on insect pests and their control in Peru in 1939. *Mescinia peruella*, Schaus, caused considerable injury in autumn to the bolls of late cotton [*cf.* *R.A.E.*, A **28** 513]. Infestation was most serious in districts having a damp climate and least so at high altitudes. *Heliothis virescens*, F., continued to spread on cotton [*cf.* **29** 11, etc.]. The eggs are laid principally on the young leaves of the terminal shoots, and the larvae migrate to the buds and bolls, feeding very little on the leaves, except on young plants on which buds have not yet been formed. Pupation occurs in the soil. Some of the autumn pupae hibernate, but others give rise to adults during the winter. The chief food-plant at this season is chick pea [*Cicer arietinum*], but the larvae also occur on cotton when it is present. Trap crops of chick pea afford the best means of control [*cf.* **28** 279; **29** 11]; other measures are cultivation of the soil to destroy the pupae and the use of a dust of equal parts of calcium arsenate and sulphur on young cotton. It is emphasised, however, that the best prospect of control lies in the abandonment of ratoon cultivation and the establishment of a close season, possibly in June and July, accompanied by rigorous field sanitation.

Infestation of cotton by *Dysdercus ruficollis*, L., was light at the beginning of the year, following very sunny weather at the end of 1938. Migration to wild food-plants began in July, and development was favoured by the mild winter. Parasitism by the Tachinids, *Acaulona peruviana*, Tns., and *Paraphorantha peruviana*, Tns., was high in September. The stainers returned in numbers to cotton in October, but the infestation gradually diminished in November, except in one valley, in which it continued until the end of the year. This diminution was due to sunny weather and parasitism by the Tachinids, which reached 50 per cent. Infestation by *Anthonomus vestitus*, Boh., was not serious, and in July 90 per cent. of the larvae were parasitised by the Braconid, *Triaspis vestiticida*, Vier. Damage was caused to cotton in various localities by *Anomis luridula*, Gn. (*texana*, Riley); parasitism of the larvae by *Eucelatoria australis*, Tns., was high locally and exceeded 60 per cent. in March in one valley. The failure of dusts of calcium arsenate to give control was attributed to the lateness of the treatments and to insufficient rates of application for the heavy populations present. Infestation of the new crop occurred at the end of the year, but 80 per cent. of the larvae were parasitised by *E. australis* in one valley. In laboratory experiments by F. F. Bibby, two dusts of cryolite and sulphur (1 : 4 and 1 : 1) gave 90 per cent. mortality of the larvae in 5 and 9 days, respectively, whereas the calcium arsenate dust usually employed against them killed 95 per cent. in 24 hours and 100 per cent. in 48. Observations on parasitism showed that *E. australis*, which also attacked *Alabama argillacea*, Hb., was most active in the valleys of central Peru. Further north, the commonest parasite of *Anomis* was a species of *Rhogas*, while in some districts up to 15 per cent. of the larvae were parasitised by a Braconid probably belonging to the genus *Microbracon*.

A brief account is given of investigations showing that a leaf-curl of cotton first observed in the Huaura Valley in 1938 was most probably caused by the feeding of an undescribed Jassid of the genus *Empoasca* that has not previously been observed to cause economic injury. In experiments on control, a sulphur dust killed or repelled over 70 per cent. of the Jassids and gave better control than several other dusts an sprays. A form of leaf-curl in the Piura Valley was caused by another Jassid, *Oncometopia minor*, Osb., and one that appeared in October in the Cañete Valley was associated with the Coccinellid, *Psyllobora luctuosa*, Muls., which apparently attacked the leaves in the absence of Aphids, on which it is predacious. Other pests of cotton included *Leucothrips theobromae*, Priesn. [*cf.* **28** 513], *Aphis gossypii*, Glov., *Eriophyes gossypii*, Banks, *Pseudococcus* sp., which injured the bolls in damp fields, and *Lasioderma serricorne*, F., which was favoured by high temperature, and attacked cotton seed just before it was harvested.

Diatraea saccharalis, F., was recorded from sugar-cane, rice, which was also attacked by the Delphacid, *Sogata orizicola*, Muir, wheat and maize. The distribution of *Aphelinus mali*, Hald., was continued against *Eriosoma* (*Schizoneura*) *lanigerum*, Hsm., on apple. *Ascogaster quadridentata*, Wesm. (*carpocapsae*, Vier.), which was released in an apple orchard near Lima against *Cydia* (*Carpocapsa*) *pomonella*, L., in December 1937, was still present there in small numbers in 1939. Injury to the trunks of apple in several localities was caused by the Cerambycid, *Neoclytus unicolor*, Lap. & Gory, the Lamiid, *Amniscus polyraphoides*, White, *Bostrychopsis eremita*, Er., and an unidentified Buprestid, and infested trees dried up and died.

An outbreak of *Icerya purchasi*, Mask., on various fruit trees, including *Citrus*, fig and mango, occurred in the Pisco Valley, and a search was made in July near Huánuco for *Rodolia* (*Novius*) *cardinalis*, Muls. Both the Coccid and the predator were extremely scarce on *Citrus*, but the weeds, *Spartium junceum* and *Ambrosia artemisifolia*, were heavily infested by *Icerya*, and the Coccinellid was common on them. A colony of 300 larvae and adults of the latter was transported to Pisco, and the outbreak was controlled within four months. The percentage parasitism of *Saissetia oleae*, Bern., on olive by the three introduced parasites [*cf.* **28** 513, 514] reached about 70 in January and February ; *Lecaniobius utilis*, Comp., was the commonest, while *Scutellista cyanea*, Motsch., was rare. The percentage parasitism fell rapidly during the winter, only 5 per cent. of the new generation being parasitised in September, but rose rapidly to about 60 in November. Peaches near Lima and in the coastal valleys were severely attacked by *Aulacaspis pentagona*, Targ., but 80 per cent. of the Coccids were parasitised by a species of *Prospaltella*. Other pests observed during the year included *Laphygma frugiperda*, S. & A., and *Feltia experta*, Wlk., on the terminal leaves and shoots of flax, and *Empoasca* sp., the nymphs but not the adults of which were associated with a mosaic of the leaves of potato.

SEIXAS (C. A.) & DO AMARAL (S. F.). **Uma praga da batata doce** (*Euscepes postfasciatus*). [A Pest of Sweet Potato.]—*Biologico* **7** no. 4 pp. 100–104, 4 figs. São Paulo, 1941.

In view of the fact that sweet-potato tubers in the State of São Paulo, Brazil, are severely attacked by *Euscepes postfasciatus*, Fairm. (*batatae*, Waterh.), an account of the bionomics and control of this weevil is given from the literature [*cf. R.A.E.*, A **26** 446].

LIEBERMANN (J.). **Los acridios sedentarios y su relación con la producción de forajes.**—*An. 2 Congr. Rio Grand. Agron., Pôrto Alegre 1940* pp. 365–371, 8 refs. [Buenos Aires] 1940.

In this paper, which was read before the Second Agricultural Congress of Rio Grande held at Porto Alegre, Brazil, in 1940, it is stated that the areas under lucerne in Argentina occupied about 32,500 sq. miles in 1920 and about 23,000 in 1934, the reduction being particularly marked in the Provinces of Buenos Aires, Mendoza and San Juan, where considerable outbreaks of grasshoppers had recently taken place. The main species involved were *Trigonophymus* (*Dichroplus*) *elongatus*, Giglio-Tos, *T. arrogans*, Stål, and *Scyllinops* *variabilis*, Bruner. Natural pastures in the Province of Entre Rios suffered damage from *Scotussa rubripes*, Bruner, accompanied by *Aleuas lineatus*, Stål. The Congress passed a resolution recommending South American Governments to organise studies on the taxonomy, distribution and ecology of Acridids, in view of the importance of the losses they cause to forage production.

Bosq (J. M.). **Apuntes sobre insectos que pueden ser de interes para la agricultura argentina.** [Notes on Insects of possible Interest to Argentine Agriculture.]—*Rev. chil. Hist. nat.* **43** pp. 49–51. Santiago, 1940.

These notes include a record of an example of *Prionobrachium fuscum*, Hust., on cotton in Tucumán ; this weevil usually develops in the fruits of *Abutilon*. In La Pampa, the branches of a eucalyptus tree (*Eucalyptus viminalis*) that had been killed by the Cerambycid, *Phoracantha semipunctata*, F., boring in the trunk were found to be tunnelled by the Bostrychids, *Bostrychopsis uncinata*, Germ., var. *orbignyi*, Lesne, and *Xyloprista hexacantha*, Fairm. In Buenos Aires, superficial injury to potato tubers was caused by the larvae of a Eumolpid of the genus *Typophorus*, possibly *T. nigritus*, F., which has previously been recorded from tubers of sweet potato, on the leaves of which the adults are common. The Coreid, *Leptoglossus gonagra*, F., which had previously attacked *Citrus*, cucurbits and *Passiflora*, was observed on tobacco in Misiones.

Porter (C. E.). **Notas breves de entomologia agrícola.**—*Rev. chil. Hist. nat.* **43** pp. 139–140. Santiago, 1940.

These records of beneficial and injurious insects in Chile include *Bruchus elegans*, Blanch., from the fruits of *Schinus molle* ; the Cerambycid, *Phymatioderus bizonatus*, Blanch., from the trunk of *Eucalyptus* ; and *Agromyza* (*Liriomyza*) *huidobrensis*, Blanch., from broad beans. Many individuals of the third generation of *Icerya purchasi*, Mask., on roses were attacked in November by the introduced Sciomyzid, *Cryptochetum iceryae*, Williston. The Coccinellid, *Adalia bipunctata*, L., which had not previously been recorded from Chile, was observed on rose trees attacked by Aphids.

Miller (N. C. E.). **Insects associated with Cocoa** (*Theobroma cacao*) **in Malaya.**—*Bull. ent. Res.* **32** pt. 1 pp. 1–16, 2 pls. (1 col.), 12 refs. London, 1941.

An account, based on observations on experimental plantings, is given of the pests of cacao in Malaya, of which the most important are the Melolonthid, *Apogonia cribricollis*, Burm., the adults of which attack the leaves, and the Capsid, *Helopeltis theobromae*, Miller [*R.A.E.*, A **28** 229], which attacks the pods. Notes on the general distribution and the history of the genus *Helopeltis* are included, together with a list of the food-plants of 12 species of economic importance.

A. cribricollis is very abundant and, besides cacao, the adults attack coffee, yams (*Dioscorea* sp.), gutta-percha (*Palaquium gutta*) and many other plants. They remain concealed in the soil during the day, and become active at night. The larvae probably feed chiefly on decaying vegetable matter, but also attack living roots. Control measures comprise hand collection of the adults, treating the soil by digging in 2 oz. calcium cyanamide at a depth of 3 ins. at the base of each tree, and spraying the leaves with lead arsenate (2 lb. in 50 gals. water). During dry weather, the deposit from this spray remains effective for several weeks.

Zeuzera coffeae, Nietn., is the most important pest of the branches and shoots. Its eggs are deposited in crevices in the bark near the ends of the branches, and the larva enters the branch and bores along it ; it makes an exit-hole before it pupates and thus weakens the branch, which may be snapped off by wind. A Braconid of the genus *Glyptomorpha* has been bred from this Cossid in Malaya. A list is given of some of its food-plants, which include coffee, tea, lime, kapok, cotton and *Hydnocarpus wightiana* in Malaya, and many others, among them forest trees, in Java [*cf.* **29** 270], where it is unimportant. Control measures comprise frequent inspection and destruction by burning of infested branches.

Nymphs and adults of *Helopeltis theobromae*, all stages of which are described, are most abundant in places sheltered from sun, heavy rains and strong winds. Eggs are deposited singly or in small groups in the pods or, if these are absent, in young shoots ; development is completed on the tree on which the nymphs hatch. The egg stage and the first nymphal instar last 6–7 and 5–6 days, respectively, and the remaining four nymphal instars each occupy 3 days. Since pods on cacao grown at low elevations take 5–6 months to mature, at least 6 successive generations of the Capsid could develop on individual trees, but this rarely occurs since it is influenced by weather conditions, especially drought, during which it seeks more humid conditions elsewhere. Elongated and depressed pale brown areas develop on the injured shoots and eventually coalesce, and if several punctures are made close together, decay sets in. Injury to the pods consists in circular brown spots that become black and scab-like, but no correlation was found between it and the premature fall, retarded development, or distortion of pods. In some cases, seeds in badly injured pods appeared to be unaffected. Damage due to oviposition is not serious. Two applications, by means of a rotary hand-duster with a single nozzle, of a dust containing pyrethrum and lime (1 : 2) at an interval of a week effectively controlled *H. theobromae*, but the efficacy of the treatment was probably enhanced by dry weather at the time.

Briefer notes, including records of alternative food-plants in some cases, are given on a number of other insects that attack cacao. They include the Noctuid, *Plusia chalcites*, Esp., the Halticid, *Podagrica* (*Nisotra*) *gemella*, Erichson, and the weevil, *Hypomeces squamosus*, F., which feed on the leaves ; the Berytid, *Gampsocoris pulchellus*, Dall., which attacks the young shoots, causing them eventually to wilt, and of which the nymphs and adults are described ; the mealybugs, *Pseudococcus lilacinus*, Ckll. (*crotonis*, Green) and *Phenacoccus iceryoides*, Green, and the Coreid, *Anoplocnemis phasiana*, F., which attack the branches and shoots ; and various secondary pests, chiefly Coleoptera, that attack branches that have died as a result of injury by *Zeuzera coffeae* and pods killed by *H. theobromae* or other agents.

FERRIÈRE (C.). **New Species of Euplectrini (Hym. Chalcidoidea) from Europe, Africa and Asia.**—*Bull. ent. Res.* **32** pt. 1 pp. 17–48, 2 refs. London, 1941.

In this revision of the EUPLECTRINI in collections, chiefly from South Africa, in the British Museum and material received by the Imperial

Institute of Entomology, the author recognises 49 species in 5 genera; many of the former and two of the latter (*Metaplectrus* and *Platyplectrus*) are new. Keys are given to the genera and to the species, and notes on the latter include information on the distribution and hosts where known. The habits of members of the genus *Euplectrus* are briefly described; all are ectoparasitic on Lepidopterous larvae.

The new species include *Neoplectrus areolatus* from *Orthocraspeda catenatus*, Sn., in Celebes and *Setora nitens*, Wlk., in Malaya; *Metaplectrus thoseae* from *Thosea cervina*, Moore, and *Natada nararia*, Moore, in Ceylon and from a Limacodid on *Uscana gambir* in Sumatra; *Platyplectrus natadae* from *N. nararia* in Ceylon; *P. orthocraspedae* from *O. trima*, Moore, and *S. nitens* in Java, and from *O. catenatus* in Celebes; *P. ornatus* from *Niphadolepis alianta*, Karsch, on coffee in Tanganyika and from South Africa; *Euplectromorpha malayensis* from a Limacodid on *Cinnamomum zeylanicum*, *S. nitens* and *Parasa lepida*, Cram., in Malaya and from *Thosea* sp. in Java; *E. salomonis* from a Zygaenid on ginger in the Solomon Islands; *E. kiambuensis* from *Tortrix dinota*, Meyr., in Kenya; *E. obscurata* from a Lymantriid on cotton and *T.* (*Cacoecia*) *occidentalis*, Wlsm., in Nyasaland and from Uganda and South Africa; *Euplectrus indicus* from a Geometrid on mustard, a cocoon on a leaf of teak (*Tectona grandis*) and *Apanteles obliquae* var. *niger*, Wlkn., in India; *E. parvulus* from *Plecoptera reflexa*, Gn., on *Dalbergia sissoo* in India and from a Pyralid on *Stephegne diversifolia* in Burma; *E. coimbatorensis* from a larva on leaves of egg-plant (*Solanum melongena*) in India; *E. petiolatus* from a Lymantriid on teak in India; *E. epiplemae* from a larva on coffee in Uganda, *Leucoplema* (*Epiplema*) *dohertyi*, Warr., on coffee in the Belgian Congo, and from South Africa; *E. singularis* from a larva on coffee and a cocoon of *Apanteles* in Uganda; *E. hargreavesi* from a larva on sweet potato in Uganda; *E. laphygmae* from *Laphygma exempta*, Wlk., in Nyasaland, Southern Rhodesia and South Africa, *L. exigua*, Hb., on tobacco in Nyasaland, *Plusia orichalcea*, F., on soy beans in South Africa, *Heliothis* sp. in the Sudan, a Geometrid on cabbage in Senegal, and a Noctuid in Uganda; *E. cacoeciae* from *Tortrix* (*Cacoecia*) *rosana*, L., in Bulgaria; *E. phthorimaeae* from *Gnorimoschema* (*Phthorimaea*) *operculella*, Zell., in Cyprus and from Palestine; and *E. liparidis* from *Lymantria dispar*, L., in Algeria. The original descriptions of 13 Asiatic species of *Euplectrus* that were omitted from the revision because the descriptions were inadequate for accurate determination and the types were unavailable are given in an appendix, which also contains a re-arrangement of a key to the Indian species by Mani.

MAMET (R.). **A new Mealy Bug attacking Pineapple Plants in Mauritius.**—*Bull. ent. Res.* **32** pt. 1 pp. 57–59, 1 fig. London, 1941.

Examination of mealybugs from pineapple plants in Mauritius [*cf. R.A.E.*, A **28** 145] showed that, in addition to *Pseudococcus brevipes*, Ckll., another species also occurs on pineapple there; it is described from the adult female as *P. pseudobrevipes*, sp. n. A key to the mealybugs collected on pineapple throughout the world is appended.

KRISHNA AYYAR (P. N.) & MARGABANDHU (V.). **Biology of the Cotton Stem-weevil, *Pempherulus affinis*, Fst., under controlled physical Conditions.**—*Bull. ent. Res.* **32** pt. 1 pp. 61–82, 1 pl., 7 figs., 24 refs. London, 1941.

The following is based on the authors' discussion and summary of the results of laboratory studies on the physical conditions affecting the adult longevity, oviposition and immature stages of *Pempherulus affinis*, Faust, on cotton that were begun in India in 1937. A technique for evaluating the effects of temperature and relative humidity was developed and is described. The upper vital temperature limit for adults is about 100°F., and the upper thermal death point about 122°F., an exposure of 6 hours being needed for mortality at that temperature, and one of 48 hours at 113°F. Above 100°F., variations in humidity have no effect on longevity. Adult longevity increased from 6 hours to 98 days as the temperature was lowered from 122 to 91°F., and reached its maximum, with oviposition, at 91°F. and a relative humidity of 73 per cent. At normal temperatures (about 93°F.), a high degree of humidity (60–80 per cent.) is necessary for maximum adult longevity. Within vital limits, the optimum humidity varies directly with the temperature, lying between 60 and 80 per cent. at 93°F., and between 80 and 100 per cent. at 100°F. The upper temperature limit for oviposition is about 113°F., but those for hatching and embryonic development are somewhat below and near 100°F., respectively. Oviposition occurred at a wide range of humidities ; the optimum for it varied between 80 and 100 per cent. at 100°F., and between 60 and 80 per cent. at 93°F. ; at 91°F. it was about 73 per cent. The incubation period was only slightly affected by variations in humidity at normal temperatures ; the optimum humidity for hatching and survival of the larvae was 100 per cent., although hatching, which at 60 per cent. was only partial, was complete at 80 per cent. The greatest mortality occurs in the egg and early larval stages, which are very sensitive to desiccation. Some pre-pupae and pupae can develop in humidities as low as 0–40 per cent., but one of 100 per cent. is unfavourable, owing to fungous growth. The rate of development of mature larvae, prepupae and pupae varied inversely with the humidity ; at 93°F. and 100 per cent. the life-cycle occupied 66 days, whereas when the mature larvae were transferred from 100 to 60 per cent. it occupied only 52.

The occurrence of *P. affinis* only in irrigated crops can be attributed to its high requirement of moisture and not to varietal preferences, and its distribution is confined to districts where moist, humid conditions prevail.

GOLDING (F. D.). **Capsid Pests of Cacao in Nigeria.**—*Bull. ent. Res.* **32** pt. 1 pp. 83–89, 23 refs. London, 1941.

The Capsid pests of cacao in West Africa are discussed from the literature, and notes are given on the occurrence in recent years in two districts in southern Nigeria of *Sahlbergella singularis*, Hagl., *S. theobroma*, Dist., and a species of *Helopeltis*, here recorded as *H. bergrothi*, Reut., which was first found attacking the shoots and pods of cacao in southern Nigeria in 1939. The identity of the species of *Helopeltis* that occur in West Africa is discussed. Orange and red Capsids collected on cotton in southern Nigeria in 1925 were identified as

H. bergrothi and *H. sanguineus*, Popp., respectively [*R.A.E.*, A **14** 323], but H. Hargreaves, who received examples of both Capsids from the author in 1934 and apparently bred out series of adults, considered them both to be forms of *H. bergrothi* [*cf.* also **14** 223]. During the last 12 years, *Helopeltis* has become one of the most important pests of cotton in southern Nigeria, and orange males and red females have been observed pairing in the field. G. S. Cotterell recorded *H. bergrothi* on cotton in British Togoland in 1928, but in 1935 he informed the author that the species had recently been identified as *H. labaumei*, Popp. J. V. Leroy recorded *H. bergrothi* from cotton in the Belgian Congo [**25** 193] and gave coloured illustrations of the adults, nymphs and eggs. Coloured illustrations of the same stages of *H. bergrothi* on cacao in the Gold Coast, where it is a well-known pest of this plant, were given by Cotterell in a paper already noticed [**17** 51], and from a comparison of these two series of illustrations, the author considers that they represent distinct species. The species found on cacao by the author in 1937 differed from the one attacking cotton there, and the nymphs resembled, although the adults differed from, those on cacao in the Gold Coast illustrated by Cotterell. It was subsequently identified as *H. bergrothi*, but in the author's opinion it is distinct from the species on cotton in Nigeria and the Belgian Congo, which he believes to be identical.

The author considers that *Helopeltis* is responsible for more damage to cacao in West Africa than is generally realised and that most of this occurs during a restricted period in the rainy season. In notes on the cause of die-back of cacao, which is generally believed in the Gold Coast to be associated with attack by *Sahlbergella* [*cf.* **14** 570, etc.], the author points out that one of the symptoms characteristic of injury by *Sahlbergella* can also be caused by *H. bergrothi* and another by root disease. In October 1939, many trees suffering from physiological die-back in a locality in southern Nigeria were found to be severely injured by thrips [*cf.* also **17** 50]. In another district, where *Solanum verbascifolium* is common among cacao, seven species of Rhynchota were observed on both plants, *viz.*, *H. bergrothi*, *H. westwoodi*, White, *Piezosternum fallax*, Bredd., *Halyomorpha reflexa*, Sign., *Acanthocoris dentatus*, Hagl., *Cletomorpha lancigera*, F., and *Pochazia fasciata*, F. The importance of *S. verbascifolium* as an alternate food-plant of cacao pests is uncertain, since, with the exception of *Helopeltis bergrothi* and *C. lancigera*, none of these species was numerous on cacao.

HUSAIN (M. A.) & LAL (K. B.). **The Bionomics of *Empoasca devastans* Distant on some Varieties of Cotton in the Punjab.**—*Indian J. Ent.* **2** pt. 2 pp. 123–136, 1 pl., 12 refs. New Delhi, 1940.

An account is given of observations on the bionomics of *Empoasca devastans*, Dist., carried out at Lyallpur in 1935–37 in view of the increasing damage it has caused to cotton in the Punjab during the last 25 years. All stages of this Jassid are described and a list is given of 17 species of *Empoasca* that have been recorded on cotton in various parts of the world. Other plants on which *E. devastans* was observed breeding at Lyallpur were hollyhock (*Althaea rosea*), castor (*Ricinus communis*), egg-plant (*Solanum melongena*), potato, *Hibiscus esculentus*, and *H. vitifolius*, the last two being much favoured, while at Delhi it bred on *H. cannabinus* and cucurbits. Eggs are laid in the leaf veins and hatch in 4–11 days. The maximum number of eggs deposited by one female was 29, but females in captivity usually laid only about 15. The duration of the nymphal stage ranges from 7 days in autumn to 21 days in winter, and the nymphs feed on the leaves, at first near the bases of the veins and later over the whole of the lower surfaces. Unmated adults survived for more than three months, but mated examples did not live longer than 5 weeks in summer and 7 in winter. Breeding occurs throughout the year at Lyallpur, except possibly from late January to late March. In early spring, eggs are deposited on hollyhock, egg-plant and potato, and infestation spreads from these to ratoon cotton and *H. esculentus*. Cotton seedlings are attacked at the end of June, and from then onwards *H. esculentus* and American cotton are heavily infested. About the beginning of November, the population declines on cotton and *H. esculentus*, and a little later on *H. vitifolius*, but increases on potato, hollyhock and egg-plant, which are the chief winter food-plants. Eleven generations, lasting 15–46 days, were observed in a year, but there is considerable overlapping.

Cotton is usually most susceptible to attack in the preflowering stage, which occurs in the Punjab when it is 8–10 weeks old. Both nymphs and adults injure the plants chiefly by injecting toxic saliva into the tissues ; there is no evidence that they transmit any virus to the plants. On varieties that are resistant to attack, the first symptoms are a wilting of the leaf, followed by the drying up of the apex and periphery, which become brown and necrotic. On susceptible varieties, there is a general mottling and curling of the leaf, and later in both, the leaf assumes a brick-red colour with strips of yellowish green along the principal veins. In the Punjab, the native cottons are more or less resistant, while American cottons are in general susceptible, though there is considerable local variation. Investigations on the factors conferring resistance showed that nymphs of all instars are able to feed and develop on both susceptible and resistant, hairy and non-hairy varieties of cotton, that there is no reduction in fertility in adults from nymphs reared on resistant plants, but that there is marked reduction in oviposition (or possibly hatching) on resistant varieties. Further investigations showed that, other conditions being equal, early sown cotton is less liable to attack ; that maximum infestation occurs immediately preceding bud formation ; that various manurial and irrigation treatments did not affect the incidence of the Jassid ; that there was no apparent correlation between the pH of the leaf sap and susceptibility to attack ; and that while nearly all resistant varieties of cotton are hairy [*cf. R.A.E.*, A **26** 261] not all hairy varieties are resistant.

In investigations in the Punjab on control, catching the adults with hand nets was found impracticable on a large scale, and light-traps were ineffective. Dusting with a mixture of calcium cyanide and wood ash (1 : 8) gave over 90 per cent. mortality, but was expensive, while spraying with resin soap and with resin compound [resin and sodium carbonate (*cf.* **20** 554)] was successful on a small scale ; sprays containing nicotine have given good results against adults and nymphs in Madras. No parasites have been recorded from *E. devastans* and little control is afforded by predators (ants and spiders). The development of resistant varieties of cotton offers the greatest promise of control.

ROONWAL (M. L.). **Preliminary Note on some Directional Changes among Locusts and other Acrididae, and the Importance of the Third Instar.**—*Indian J. Ent.* **2** pt. 2 pp. 137–144, 1 fig., 12 refs. New Delhi, 1940.

This is a review of the literature on the changes that occur in relative growth, behaviour [*R.A.E.*, A **25** 74, 646] and rate of respiration [**18** 185 ; **24** 229] during the nymphal development of Acridids, and on the occurrence of an extra instar between the third and fourth [**22** 8 ; **24** 232]. It appears that important morphological and physiological changes are connected with the moults from the third and fourth instars.

JANJUA (N. A.). **On the Biology of** *Cacoecia sarcostega* **Meyr. in Baluchistan.**—*Indian J. Ent.* **2** pt. 2 pp. 145–154, 5 figs., 5 refs. New Delhi, 1940.

Some of the information in this account of the life-history of *Tortrix* (*Cacoecia*) *sarcostega*, Meyr., which has caused increasingly serious damage to fruit trees in Baluchistan in recent years and now ranks as a pest of primary importance, is similar to that already noticed [*R.A.E.*, A **27** 51]. Larvae are common on apple, peach, nectarine, apricot and several varieties of plums and have also been observed feeding on the leaves of cherry, pear, quince and several other trees. They injure the buds, flowers, fruit and foliage of apple and damage up to 25 per cent. of the leaves, but in the case of stone fruits, the chief damage is that caused to the ripe fruit. In some gardens, the entire plum and nectarine crops have been spoiled.

All stages of this Tortricid are described. In the Quetta Valley there are three generations a year, the adults of which emerge in May–June, July and August–September, and the winter is passed in the third larval instar. The durations of the preoviposition period and the egg, larval, prepupal and pupal stages averaged 3·8, 9·4, 30·8, 8·2, and 13·3 days, respectively, for the first generation, and 3·4, 7·1, 25·9, 5·8 and 8·1 days for the second. For the third (overwintering) generation, the preoviposition period and the egg stage averaged 3·9 and 10·3 days, respectively, the periods of larval feeding before and after hibernation 28·9 and 25·3 days, the duration of hibernation 189·9 days, and the prepupal and pupal stages 6·7 and 14·2 days. The numbers of eggs laid per female averaged about 298, 234 and 260 for the three generations ; they are deposited in irregular masses of 16–190 on the upper surface of the leaves. The larvae were parasitised by a Bethylid of the genus *Perisierola*.

CHERIAN (M. C.) & BASHEER (M.). *Euborellia stali* **Dohrn (Forficulidae) as a Pest of Groundnut in South India.**—*Indian J. Ent.* **2** pt. 2 pp. 155–158, 8 figs. New Delhi, 1940.

In 1938, the authors observed the Forficulid, *Euborellia stali*, Dohrn, which is probably widely distributed in southern India, feeding on the kernels of pods of ground-nut (*Arachis hypogaea*) in the soil in Madras. At harvest from 2·7 to 19·95 per cent. of the pods were infested. This is the first record of a pest attacking the underground parts of ground-nuts and also the first of an earwig attacking a crop plant in India. Brief notes are given on the appearance of all stages, and the process of nymphal development is described. The adults paired 7–10 days after emergence, and oviposition began 10–23 days later. The eggs were laid in clusters of up to 28 in the soil and in the pods, 7 females laying an average of 58 eggs in the laboratory. The nymphs pass through five instars, and the duration of the total life-cycle from egg to adult ranged from 56 to 72 days. The adults were fairly long-lived, 7 females surviving for 106–252 days. The earwigs also fed on cabbage, cotton bolls and stems of *Sorghum* in the field, while in the laboratory they fed on cabbage and sometimes on one another.

BHATIA (D. R.). **Observations on the Biology of the Desert Locust** (*Schistocerca gregaria* **Forsk.**) **in Sind-Rajputana Desert Area. I. The preferred Food Plants of the Locust.**—*Indian J. Ent.* **2** pt. 2 pp. 187–192, 3 refs. New Delhi, 1940.

This is a summary of the results of investigations in the Sind-Rajputana desert on the food preferences of *Schistocerca gregaria*, Forsk., phase *solitaria*. Field observations were checked by experiments in cages, in which hoppers showed a preference for *Pennisetum typhoideum*, *Sesamum indicum*, *Indigofera cordifolia*, *Tephrosia hookeriana* and *Tribulus terrestris*. When these were not available, they fed on other plants ; lists are given of the plants that were readily and sparingly eaten.

Fresh samples of sparingly eaten species were eaten more readily than semi-dry or mature samples of preferred plants. In the field, *Tribulus terrestris*, *Tephrosia hookeriana* and *Cyperus arenarius* were selected when fresh, but the deep rooted perennial, *Aerua javanica*, which remains green for a long time, was preferred when the others were no longer tender. It is suggested that preference for certain plants may, when their distribution is localised, lead to a concentration of hoppers and adults and to phase transformation. After the development of the gregarious instinct, all stages seem to prefer tall-growing plants, such as *Capparis aphylla* and *Calligonum polygonoides*.

Calotropis gigantea and *Melia azadirachta* (*Azadirachta indica*) were refused by hoppers and adults, and the readily eaten *Pennisetum typhoideum* and water-melon (*Citrullus vulgaris*) were not eaten when they were sprayed with an extract of *M. azadirachta* [*cf. R.A.E.*, A **25** 670 ; **26** 180]. Spraying the plants with an extract of *Calotropis* did not make them unattractive.

RAMCHANDRA RAO (Y.). **Some Observations on the Periodicity of Locust Invasions in India.**—*Indian J. Ent.* **2** pt. 2 pp. 193–199. New Delhi, 1940.

Recent investigations on locusts in various parts of the world, including India, are briefly outlined [*cf. R.A.E.*, A **22** 704 ; **26** 676 ; **27** 475] and particulars are given of important locust species that occur in India, with the dates of outbreaks. These species include the migratory and Bombay locusts [*Locusta migratoria*, L., and *Patanga succincta*, L.], but they are much less important than *Schistocerca gregaria*, Forsk. On the basis of investigations during and after the last outbreak of this species in 1926–31 [**22** 707 ; **24** 443 ; **25** 390 ; **26** 628], an account is given of the causes and course of its swarming cycles. In the outbreak years, swarms overwinter in northern Sind and the southern Punjab and on the Mekran coast of Baluchistan, where they remain inactive and scattered during cold weather. They sometimes breed in early spring, and a general northward movement begins in March, when swarms from Mekran move along the mountain valleys into northern Baluchistan, western Afghanistan and eventually to the North-West Frontier Province. Breeding takes place in this area in April–June, and the new generation moves eastward into the Punjab, Sind and Rajputana in May–July. Swarms overwintering in the Punjab breed in spring, the new generation moving eastwards into the United Provinces, Bihar and Bengal in May–June. In all the invaded areas, breeding begins with the summer monsoon, and one or more generations are produced. By September–October, these areas become hot and dry, and the locusts migrate, according to the prevailing winds, eastwards into the United Provinces, Bihar and Bengal, southwards into Gujarat or westwards into Baluchistan. As only the locusts that move westwards reach areas with winter rains during which they can breed, an autumn migration in this direction is essential for the continuation of an outbreak. The occurrence of drought in areas of either winter or summer rainfall may cause a break in the locust cycle. The last outbreak might have terminated in 1929, as there was no westward migration in the autumn of 1928 and a drought occurred in the spring of 1929, but the local swarms were supplemented by an influx from Arabia and Iran. The cycle was brought to a close following light breeding in the spring and summer of 1931 and the failure of the winter rains in Mekran in 1932.

The outbreaks are initiated by the following series of events: extensive breeding in coastal Mekran, favoured by heavy winter-spring rains; a spring migration into the interior of Baluchistan and the production there of incipient swarms by crowded oviposition on patches of cultivated plants; the migration of incipient swarms into Rajputana [**25** 161]; and extensive breeding there during the monsoon rains in July–September, followed by breeding of concentrations of locusts, determined by localised rainfall, and the formation of large swarms.

The present outbreak of *S. gregaria* in India began in 1940. Some breeding up had already started in the spring of 1939, following favourable winter rainfall in Mekran, but the increase in numbers was not noticeable and the monsoon brood was also poor. Early spring breeding in 1940 in Mekran was moderate, but fairly large numbers of locusts occurred in the summer in the Rajputana desert. It appears that these became concentrated on vegetation rendered patchy by the previous year's drought. Crowded breeding ensued after the heavy showers in August and led to the reappearance of swarms. The outbreaks in 1869, 1900 and 1912 were caused by similar meteorological conditions. To prevent locust invasions of India, it is essential to control incipient outbreaks in the Sind-Rajputana desert and in the British and Iranian Mekran.

RAHMAN (K. A.) & SAPRA (A. N.). **Biology of the Mite,** *Paratetranychus indicus* **Hirst, a Pest of Sugarcane in the Punjab.**—*Indian J. Ent.* **2** pt. 2 pp. 201–212, 12 figs., 3 refs. New Delhi, 1940.

Paratetranychus indicus, Hirst, all stages of which are described, is widely distributed in India and is a serious pest of sugar-cane in the Punjab, where it also feeds on *Sorghum vulgare* and *S. halepense*. As many as 30 overlapping generations were observed in the course of a year; all stages occur together and breeding is continuous. The oviposition period lasted 10–15 days from April to September, and 17–39 days during March and October–December, and the daily and total numbers of eggs deposited by females under observation were 1–7 and 35–69. During April and May the females died immediately after they had finished ovipositing, but in June–November they survived for a further period of 1–6 days. Males died within 4 days of mating, but unpaired examples survived for up to 12 days in March–September and 20 in October and November. The egg stage lasted 2½–3 days in April–September, 5–13 days in March and October–December and 29 days in January. The larval, protonymphal and deutonymphal stages in males and females each lasted 1½–3 and 3–5 days, respectively, in April–September, 4½–8 and 6–11 days in March and October or November, and 13–19 and 16–24 days in December–February. Some males, however, passed through only two instars. Parthenogenesis is common, 94–96 per cent. of the eggs laid by unfertilised females giving rise to males. Females are somewhat more numerous than males, but the ratio is almost 1 : 1 in May. Infestation is spread by wind and, in fields of sugar-cane and *S. vulgare*, where the leaves touch each other, by mites crawling from plant to plant.

Adult males of *P. indicus* feed very little, and the chief damage is caused by the females and immature stages. During summer, the latter can survive starvation for 8 hours, females for 24 hours and males for 72. Feeding by the mites causes the formation of red patches, which increase in size and spread over the entire leaf, which finally falls. This red coloration is probably caused by the injection into the leaf during feeding of a toxic substance that reacts with the plant sap.

The mite is present on *Sorghum halepense* throughout the year. It spreads to *S. vulgare* and sugar-cane in May, and is active on them until July, when the monsoon rains kill all stages except the egg. Further damage is caused to *S. vulgare* in September–November, but the leaves of sugar-cane are too tough to be infested at this time. Soft-leaved varieties of sugar-cane were more susceptible to attack those having hard leaves.

Krishna Ayyar (P. N.). **The alternate Host Plants and associated Parasites of** *Pempheres affinis* **Faust in South India.**—*Indian J. Ent.* **2** pt. 2 pp. 213–227, 20 refs. New Delhi, 1940.

An account is given of investigations begun in 1937 on the alternative food-plants of the cotton stem weevil, *Pempherulus* (*Pempheres*) *affinis*, Faust, in Madras and the parasites of it that are associated with them. The weevil was observed breeding on 17 species of wild and cultivated plants, in addition to cotton, mainly belonging to the Malvaceae and Tiliaceae. *Triumfetta rhomboidea*, *Sida acuta*, *S. glutinosa*, *S. spinosa*, jute (*Corchorus olitorius*), *Malvastrum coromandelianum*, *Hibiscus esculentus*, *H. cannabinus*, *H. vitifolius* and *Pavonia zeylanica* were the most important, while the others were *Althaea rosea*, *Sida rhomboidea*, *S. rhombifolia*, *S. cordifolia*, *H. ficulneus*, *Urena lobata* and *Corchorus acutangulus*. Notes are given on the distribution and degree of infestation of these plants and on the parasites that were bred from the weevil on them, including records of the durations of their life-cycles and alternative hosts.

P. affinis breeds on cotton during most of the year. During the off-season, a small population survives even under unfavourable conditions, but more important sources of reinfestation are cotton stalks retained for thatching and fuel, and alternative food-plants. *T. rhomboidea* appears to be the preferred wild food-plant and to maintain a large weevil population independently of cotton. The weevil has developed such a high degree of preference for it that only a negligible fraction migrates directly from it to cotton and an intermediate food-plant is apparently necessary before an influx into cotton fields takes place. The commonest of these intermediate food-plants in or near cotton fields are *M. coromandelianum* and *C. olitorius*, which can easily be eradicated.

The weevil has two distinct sets of parasites, those associated with *T. rhomboidea* usually being absent from cotton fields. Of the parasites obtained, all of which were reared from the larvae, *Entedon pempheridis*, Ferrière, was the commonest; it was present throughout the year and was most numerous from September to November. This Eulophid was bred from the weevil on *T. rhomboidea, S. acuta, C. olitorius, M. coromandelianum* and *H. vitifolius* and also parasitised *Apion corchori*, Mshl., on *C. olitorius*, *Lobotrachelus* sp. on *H. vitifolius* and *Hypolixus truncatulus*, F., on *Amarantus*. *Dinarmus coimbatorensis*, Ferrière (which is stated in an editorial footnote to have been found by Pruthi & Mani to be a synonym of *D. sauteri*, Masi) was obtained from *P. affinis* on *T. rhomboidea, S. acuta, C. olitorius, S. spinosa* and *H. esculentus* and was also reared from *Hypolixus truncatulus* on *Amarantus*. *Spathius labdacus*, Nixon, was bred from *P. affinis* on *T. rhomboidea* and might prove an effective parasite if it could become adapted to the conditions obtaining in cotton fields. *Rhaconotus cleanthes*, Nixon, was obtained from *P. affinis* on *T. rhomboidea* and *S. acuta*. *R. menippus*, Nixon, was reared from *P. affinis* on *C. olitorius* and *T. rhomboidea*, but larger numbers were obtained from *Hypolixus truncatulus* on *Amarantus*. *Eupelmus urozonus*, Dalm., which has not previously been recorded from India, parasitised *P. affinis* on *S. acuta* and *H. truncatulus* on *Amarantus*. *Bruchocida orientalis*, Crwf., which parasitises *Bruchus chinensis*, L., in South India, was bred from *P. affinis* on *T. rhomboidea*. *Euderus pempheriphila*, Ram. Ayyar & Mani, parasitised *P. affinis* on *T. rhomboidea, S. acuta* and *M. coromandelianum* and *H. truncatulus* on *Amarantus*; it is itself parasitised in cotton fields by *Eupelmella pedatoria*, Ferrière. *Spathius critolaus*, Nixon, was bred from *P. affinis* on *T. rhomboidea, S. acuta, C. olitorius, M. coromandelianum, H. ficulneus, H. esculentus* and *P. zeylanica* and one individual was obtained from *Melochia corchorifera*, which is tentatively recorded as a food-plant of the weevil; it also parasitises the Buprestid, *Sinoxylon sudanicum*, Lesne, on cotton and *H. truncatulus* on *Amarantus*. *Aplastomorpha calandrae*, How., which usually parasitises Coleoptera in stored products, was obtained from *P. affinis* on *T. rhomboidea* and *S. acuta*; it is present in cotton fields. The weevil was also parasitised by the Nematode, *Geomermis indica* [*cf. R.A.E.*, A **29** 270], while ants of the genera *Tetraponera* (*Sima*) and *Monomorium* were predacious on the larvae and prepupae in tunnels in *T. rhomboidea*.

Short Notes and Exhibits.—*Indian J. Ent.* **2** pt. 2 pp. 241–246. New Delhi, 1940.

H. S. Pruthi (p. 241) reports that after several dry years there was a good rainfall in the summer of 1940 in the Sind-Rajputana desert

Schistocerca gregaria, Forsk., which was scarce till June 1940, began to breed rapidly after the rainfall, particularly in the Tharparker district of Sind and the Bikaner and Jaisalmer States of Rajputana [*cf. R.A.E.*, A **29** 520]. By the end of August, a considerable locust population was present, and the hoppers that appeared in September and the subsequent swarms of adults belonged to phase *gregaria*. By the end of October some of these had migrated to the Punjab and Baluchistan, while others invaded Delhi and the United Provinces.

G. Ullah (pp. 241–242) reports that adults of *Myllocerus laetivirens*, Mshl., which is known to be fairly common on cotton in Delhi, migrated to certain varieties of plum and almond at New Delhi. They attacked the leaves of these trees and almost defoliated some of them. The Capsid, *Creontiades pallidifer*, Wlk., breeds in Delhi on a large variety of crops: on lucerne throughout the year, on brinjal [*Solanum melongena*], berseem [*Trifolium alexandrinum*], safflower [*Carthamus tinctorius*] and hollyhock [*Althaea rosea*] from January to April, on melon and *Hibiscus esculentus* from April to June, on *Sorghum*, cucurbits, sunn hemp [*Crotalaria juncea*], ground-nuts and cowpeas from July to September, on *Cajanus cajan* and maize in October, and on cruciferous vegetables and hollyhock from November to December. In autumn it occasionally becomes a serious pest of maize and *Sorghum*.

K. A. Rahman (p. 243) reports that an examination of the wild and cultivated plants growing on the Agricultural College estate at Lyallpur during 1939–40 revealed five new food-plants of *Bemisia tabaci*, Gennadius (*gossypiperda*, Misra & Lamba). These comprise peas, flax (*Linum usitatissimum*), *Melilotus parviflora*, *Medicago denticulata* and *Coriandrum sativum*.

G. S. Sohi (p. 244) states that *Pachymerus gonager*, F., usually a pest of forest trees and shrubs, damaged stored pods of *Tamarindus indica* at Lyallpur. The eggs of this Bruchid are laid singly on the pods or, if these have been removed, on the seeds. The larvae develop in the seeds and pupate in cocoons, which usually protrude from the pods. The insect hibernates during the winter, probably in the adult as well as the larval stage.

C. K. Samuel (pp. 244–245) states that in view of the fact that *Myzus persicae*, Sulz., is known to transmit more than 20 different virus diseases of plants, a study of its food-plants at Pusa was made during 1936–39. It was found on five cruciferous vegetables, hollyhock, *Dalbergia sissoo*, peach, plum, *Ageratum conyzoides*, *Orobanche* sp., and several solanaceous plants, including potato, tomato and tobacco. Leaf-curl diseases of the virus type have often been observed in North Bihar in most of these plants. *Aphis maidis*, Fitch, has been found at Pusa on wheat and oats during January and February, on barley from January to March, on *Sorghum* during June and July, and on maize from June to August. Its presence on graminaceous crops in North Bihar may be of importance, as the cultivation of sugar-cane is rapidly increasing there and it is a vector of sugar-cane mosaic in other parts of the world.

P. M. Glover (p. 245) reports that a male and a female of *Elasmus albomaculatus*, Gah., were bred from a larva of *Holococera pulverea*, Meyr., at Namkum early in 1935. This is the first record of *E. albomaculatus* as a parasite of *H. pulverea*. The two adults were caged with larvae of *H. pulverea* and *Eublemma amabilis*, Moore, feeding on lac insects [*Laccifer lacca*, Kerr], but the female died in four days and did not oviposit. *Elasmus johnstoni*, Ferrière, was bred at Namkum in August 1938, as a parasite of a species of *Apanteles* parasitic on larvae of *Sylepta derogata*, F., on *Hibiscus esculentus*.

M. C. Cherian & C. V. Sundaram (p. 246) refer to Munro's conclusion that var. *dorsalis*, Hend., of *Dacus ferrugineus*, F., is distinguishable solely by the colour of the fore tibiae and that it is confined to Formosa [**28** 511], and state that this variety and also var. *incisus*, Wlk., were observed breeding in fruits of *Solanum auriculatum* in the Nilgiri hills.

DIAKONOFF (A.). **De veroorzaker van de rijgdraadjes** (*Cosmopteryx dulcivora* **Meyr.**). [The Producer of Thread-like Mines in Sugar-cane Leaves.]—*Arch. Suikerind. Ned. & Ned-Ind.* **2** no. 2 pp. 34–41, 4 figs., 14 refs. Pasoeroean, 1941. (With a Summary in English.)

A red, thread-like discoloration of the mid-rib is common in sugar-cane leaves in Java and is caused by the larvae of *Cosmopteryx dulcivora*, Meyr., which mine in the mid-ribs and leaf-sheaths. All stages of this Tineid are briefly described. The eggs are laid on the leaves and hatch in about 4–5 days. The larvae develop for 21–26 days in the leaves and for 9–11 in the leaf-sheaths, where they pupate. The adults emerge 9–11 days later. Some of the larvae were parasitised by *Eulophus femoralis*, Zehnt. Parasitised individuals ceased feeding, and the adult Eulophids emerged after about a week. Larvae of the Tineid die if the leaves dry up too much, so that the mines are scarce during the dry season. The injury caused to the plant is unimportant, and there is little likelihood that infestation will increase.

CHEN (S. H.). **Two new Dacinae from Szechwan.**—*Sinensia* **11** no. 1–2 pp. 131–135. Nanking, 1940.

One of the Trypetids here described is *Mellesis citri*, sp. n., which causes serious injury to sweet oranges and also attacks grapefruit in Kiangtsin and Chengtu. It was estimated that in orchards near Kiangtsin, more than 50 per cent. of the sweet-orange fruits were infested. The larvae develop in the fruits, usually causing them to fall, and pupate in the soil. To prevent the spread of the fly, all infested fruit should be promptly destroyed.

BARNES (H. F.). **Sampling for Leatherjackets with Orthodichlorobenzene Emulsion.**—*Ann. appl. Biol.* **28** no. 1 pp. 23–28, 2 figs., 4 refs. London, 1941.

An account is given of a study of the yearly fluctuations in numbers of the larvae of *Tipula paludosa*, Mg., in grassland in southern England from 1937 to 1940. The population samples were obtained by watering the turf with an emulsion of orthodichlorobenzene and Jeyes' fluid [*cf. R.A.E.*, A **25** 208, 612]. They indicated that each year there was a period, occurring at some time between February and early May and ranging from 4 to 11 weeks; when there was a fairly constant high population ; it was followed by a steady decrease in numbers, beginning on a date that varied from year to year. When a second application of the emulsion was made at varying intervals after the initial treatment, the numbers of larvae obtained increased with the intervening period, except in one case, thus showing that there is a lateral movement above or below ground [*cf.* **27** 96]. In 1940, when ten square yards were treated daily for three days in early April, the numbers of larvae obtained on each day were 130, 31 and 8, and there was evidence of lateral migration. Investigations to find evidence for a non-feeding prepupal period [*cf.* **25** 612] indicated that at a certain stage, before the larvae have finished feeding and a considerable time before pupation, they no longer respond to orthodichlorobenzene. This, and lateral migration, may explain the apparent reductions in population that followed the periods in which it was constantly high. The treatment, therefore, is satisfactory for rapid estimation of the numbers present early in the year (until March or April), provided that it is used under suitable weather conditions, but is unreliable later in the season when the larvae are approaching the fully-fed stage.

PARR (W. J.) & SPEYER (E. R.). **Some Observations on the Life History of the Angleshades Moth** (*Brotolomia meticulosa* **L.**).—*Ann. appl. Biol.* **28** no. 1 pp. 29–33, 1 pl., 19 refs. London, 1941.

The Noctuid, *Brotolomia meticulosa*, L., is common and widely distributed in Europe, and often occurs in greenhouses, where the larvae injure the flowers of chrysanthemums [*cf. R.A.E.*, A **28** 133]. They also feed voraciously on the leaves of cineraria and geranium, and caused much injury to broad beans grown under glass at Cheshunt during the winter of 1939–40 [*cf.* **29** 145]. Larvae completed their development in the laboratory on chrysanthemum, geranium and cineraria, but did not feed on hydrangea or *Polygonum*. In Britain, the larvae are usually found in greenhouses only during the autumn and winter ; apparently the eggs are laid on chrysanthemum plants before they are brought into the houses in late summer, and most of the pupae are removed with the pot soil when the crop is ended in January or February. Another generation is produced on out-door plants in late spring and early summer [*cf.* **23** 621].

Males and females that emerged from pupae kept in a heated laboratory during January and February 1939 were caged with suitable plants and sugary solutions on which to feed, but in no instance were any eggs laid. Pupae kept at much lower temperatures during the winter of 1939–40 gave rise to adults on 20th March : one female and three males were kept until 1st April in a large cage containing a cineraria plant, after which they were removed to a small one containing a chrysanthemum plant and some geranium leaves in water. During the next two nights many eggs were deposited, over 140 being scattered over the muslin covering of the cage, and 21 laid singly or in pairs on the chrysanthemum and geranium leaves. They adhered firmly to the surface on which they were deposited. The eggs were kept at room temperature, and the great majority hatched on 12th April. Of seven larvae that were bred, five passed through six instars, and two had seven. During cold spells the larvae were inclined to expose themselves upon the upper surfaces of bean leaves. Only four of the larvae gave rise to adults, the periods spent in the larval, prepupal and pupal stages averaging 46, 9 and 18 days, respectively. When fully fed, the larvae enter the soil to pupate. The pupal stage is prolonged in the winter generation ; in a warm room during the winter of 1938–39, it lasted 47–53 days for pupae from larvae fed on chrysanthemum, while in a cold one in that of 1939–40, it lasted 36 days and 3½–5 months when the larvae had fed on cineraria and broad bean, respectively.

The adults are active only at night and do not appear to be attracted to light; they feed readily on sugary solutions, but were not attracted in winter to jars containing beer and treacle in chrysanthemum houses. They are apparently long-lived, and there is a considerable period between emergence and oviposition. Two adults of the Tachinid, *Zenillia* (*Phryxe*) *vulgaris*, Fall., were reared from larvae from the commercial chrysanthemum houses at Cheshunt. Experiments on control [*cf.* **28** 133; **29** 145] showed that the best results against the larvae on foliage are given by a spray of lead arsenate. Chrysanthemums should be sprayed as soon as they are brought under glass in the autumn and at intervals of three weeks, up to three weeks before the first blooms are ready. Infested blooms should be lightly dusted with cryolite.

EDWARDS (E. E.). **The Fever Fly, *Dilophus febrilis* L., and Methods for Control of its Larvae in cultivated Lawns.**—*Ann. appl. Biol.* **28** no. 1 pp. 34–38, 6 refs. London, 1941.

Lawns that are subject to frequent mowing are sometimes seriously disfigured by brown patches caused by the feeding of larvae of *Dilophus febrilis*, L., at the roots. They are generally believed to feed mainly on decaying matter, and their presence in turf is often associated with a high proportion of decaying matter in the surface layers, or with the liberal use of farmyard manure, but on several occasions in South Wales during 1938–40, sports turf and private lawns very low in humus and known to have received no organic manure or compost for many years were severely attacked. At a golf course in Glamorgan that was severely injured in the spring of 1939, the larvae were abundant on the putting greens and fairways, and on the natural herbage adjoining the links. The humus content of the soil was exceptionally low in all cases and no organic fertiliser had been applied for several years. Injury was most severe on the putting greens, presumably owing to the poorer root system resulting from repeated cutting. The damage to turf may be general or it may be concentrated in relatively small areas ranging up to a foot in diameter. The grasses in the centre of such patches appear dead or dying, while those on the margin are only partly destroyed. A sod showing these symptoms sometimes contains 3,500 or more larvae per square foot, and the turf becomes soft and spongy, owing to the loosening of the soil round the roots. The larvae occur at a depth of about ½ inch. If the attack is severe, the injured patches increase rapidly in size and coalesce, until, finally, areas several yards in diameter are affected. If the infestation is light and the damage consists chiefly in local thinness of grass, the turf usually recovers superficially, but is liable to become infested with weeds and with an abnormal proportion of *Poa annua*. Turf on heavy soil is seldom seriously infested.

Adult emergence occurs in late April or early May and is favoured by warm, dry weather. The adults are active in bright sunshine, visiting flowers, but at dusk and in dull weather they rest among herbage or on the foliage of trees and bushes. They pair soon after emergence, and each female deposits several hundred eggs in clusters on or just below the surface of the soil. Eggs are also deposited in decaying vegetable matter, particularly round the edges of heaps of grass mowings. In summer, the egg, larval and pupal stages last 18–25 days, about 3 months and about 3 weeks, respectively, and the first-generation adults emerge in late August or early September. Larvae of the following generation overwinter and pupate in April, the pupal stage lasting about 3 weeks.

Field experiments on control were carried out in 1939 in three heavily infested areas in South Wales and Monmouthshire. The applications were made on 5th and 6th April, and counts of the living and dead larvae were made a few days later. The percentage mortalities were 69·4–74·7 when an emulsion of orthodichlorobenzene and Jeyes' fluid [*R.A.E.*, A **20** 541] was applied to the turf at the rate of 1 gal. per sq. yd.; 91·9–94·9 when a derris suspension containing 0·0054 per cent. rotenone was applied at the same rate; 97·9–98·9 when pyrethrum extract was added to this to give a content of 0·001 per cent. pyrethrin I; and 99·6–99·7 when lead arsenate powder was uniformly distributed over the turf at the rate of 1½ oz. per sq. yd. and watered into the soil with 1 gal. water per sq. yd. Dusting the ground with a preparation containing 4 per cent. mercurous chloride and watering it in gave no mortality. None of the treatments injured the herbage.

BENTLEY (E. W.), GUNN (D. L.) & EWER (D. W.). **The Biology and Behaviour of *Ptinus tectus* Boie. (Coleoptera, Ptinidae), a Pest of Stored Products. I. The daily Rhythm of locomotory Activity, especially in Relation to Light and Temperature.**—*J. exp. Biol.* **18** no. 2 pp. 182–195, 8 figs., 33 refs. London, 1941.

The following is the authors' summary. In alternating light and darkness at 25°C. [77°F.] *Ptinus tectus*, Boield., shows a diurnal rhythm of locomotory activity with maximum activity occurring in the dark period. The rhythm is continued for a few days in continuous light. In continuous light, no inherent 24 hr. rhythm is apparent, but in subsequent alternating light and darkness, within 1 day, activity becomes practically confined to the dark period. The rhythm can be reversed by reversing the hours of light and darkness, and the reversed rhythm is similarly continued in continuous light. In conditions of alternating light and darkness with fluctuating temperature (10–20°C. [50–68°F.] with low temperature in the dark periods) *Ptinus* shows greater activity than at 25°C., and maximum activity occurs in the cold, dark period. In constant light and daily fluctuating temperature (17–23°C. [62·6–73·4°F.]), the period of greatest activity occurs when the temperature is falling. After transfer to constant temperature, this period still occurs at the same time of day for a few days.

MARTIN (J. T.) & HESTER (K. H. C.). **Dermatitis caused by Insecticidal Pyrethrum Flowers** (*Chrysanthemum cinerariifolium*).—*Brit. J. Derm.* **53** pp. 127–142, 12 refs. London, 1941.

While the belief that pyrethrum is not toxic to man appears to be well-founded, some individuals are affected with dermatitis after contact with flowers or extracts, and in others, disturbances of the respiratory tract occur. Dermatitis is more often caused by the flowers than by the extracts. Fair people are likely to be more susceptible than dark, and susceptibility appeared in one of the authors only after he had been engaged in work on pyrethrum for 2–3 years. Experiments in which the product to be tested was spread on a piece of material one inch square and held against his skin for 24 hours or more indicated that the causal agent or agents of the dermatitis lay in the ovaries, receptacle and involucre, but did not occur in the pyrethrins [*cf.* *R.A.E.*, A **23** 81]. Powdered flowers gave a more intense reaction when moistened. Pollen gave only a slight reaction. A colourless petroleum ether extract of the flowers mixed with charcoal gave an intense one. The volatile oil obtained by steam distillation of powdered flowers was highly active, and the oil after the extraction of a volatile acid fraction less so. The steam-distilled flowers gave a positive reaction similar to that of the acid-free oil. It is indicated that crystalline constituents of the petroleum ether extract of the flowers may be contributory causes. Though the dermatitis was in some cases acute, in no instance was there any respiratory trouble.

SCHNEIDER (H.). **Untersuchungen über die *Acarapis*-Milben der Honigbiene. Die Flügel- und Hinterleibsmilbe. Vorläufige Mitteilung.** [Investigations on the *Acarapis* Mites of the Honey Bee. The Mite on the Wings and Abdomen.]—*Mitt. schweiz. ent. Ges.* **18** pt. 6 pp. 318–327, 5 figs., 16 refs. Berne, 1941.

The occurrence of a mite of the genus *Acarapis* that infests the wings and abdomen of the honey bee is recorded from Switzerland and has previously been observed in Germany, Austria, Hungary and Italy. A table is given showing the measurements by which this form and the other three species of *Acarapis* can be distinguished [*cf.* *R.A.E.*, A **23** 185], and it is named *A. vagans*, sp. n.

SMEE (C.). **Notes on the Locust Outbreak of 1893–1910.**—*Nyasaland Tea Ass. quart. J.* **5** no. 2 pp. 17–19. Blantyre, 1940; continued in *Nyasaland agric. quart. J.* **1** no. **1** pp. 20–22. Blantyre, 1941.

The available records on the locust invasion of Nyasaland in 1893–1910, in which *Locusta migratoria migratorioides*, R. & F., and *Nomadacris septemfasciata*, Serv., were concerned, are summarised. It is suggested that, as in 1932, the invading swarms of *Locusta* may have been the progeny of swarms originating in French Sudan [*cf.* *R.A.E.*, A **26** 684], and that the swarms of *Nomadacris* arose in the northernmost part of Northern Rhodesia [*cf.* **27** 483].

PAPERS NOTICED BY TITLE ONLY.

DAGUERRE (J. B.). **El género *Schistocerca* en la República Argentina.** [The Genus *Schistocerca* in Argentina.]—*Rev. Soc. ent. argent.* **10** no. 3 pp. 327–337, 1 pl., Buenos Aires, 1940. [*Cf.* *R.A.E.*, A **26** 689; **28** 60, 215; **29** 322.]

[LEZHAVA (V. V.).] **Лежава (В. В.). A new Species of Bark-beetle in Georgia, *Scolytus manglissiensis* sp. n. (ad interim).** [*In Georgian, Russian and German*: brief preliminary description from a fruit-tree.]—*Bull. Mus. Géorgie* **10** A pp. 71–72, 1 fig. Tiflis, 1940.

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